REPORT RESUMES

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SPILLOVER OF PUBLIC EDUCATION COSTS AND BENEFITS. PART 1--BENEFITS.

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THE STUDY DEALT WITH THE BENEFITS FROM PUBLIC EDUCATION TO PEOPLE OTHER THAN STUDENTS AND THEIR PARENTS. THE INVESTIGATION WAS A THEORETICAL ANALYSIS OF THE ECONOMICS OF PUBLIC EDUCATION. THE SCOPE OF THE STUDY INCLUDED (1) METHODOLOGICAL AND CONCEPTUAL ISSUES, (2) SOCIAL BENEFITS FROM PUBLIC EDUCATION, AND (3) PARTICULAR BENEFITS AND THEIR EXTERNAL COMPONENTS. CLAYTON, MISSOURI, WAS USED AS THE COMMUNITY TO WHICH A MULTIPLE REGRESSION MODEL OF THE DETERMINANTS OF EDUCATION EXPENDITURES WAS APPLIED. THIS MODEL DEMONSTRATED THAT EXPENDITURES PER STUDENT ARE NEGATIVELY CORRELATED WITH THE DEGREE OF SPILLOVER. THE RESEARCHERS FOUND THAT THE EFFECTS OF LOCAL DECISIONS CONCERNED WITH PUBLIC PRIMARY AND SECONDARY EDUCATION PERMEATE THE ENTIRE SOCIETY. FINDINGS HAVE ALSO SUGGESTED THAT ANALYSIS OF THE NATURE, MAGNITUDE, AND DISTRIBUTION OF BENEFITS FROM PUBLIC EDUCATION MAY PROVIDE AN EXPLANATION FOR A VARIETY OF ASPECTS OF PUBLIC BEHAVIOR INVOLVING EDUCATION. (WB)

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SPILLOVER OF PUBLIC EDUCATION COSTS AND BENEFITS

Part One: Benefits

Cooperative Research Project No. 1045

Burton A. Weisbrod
Washington University
St. Louis, Missouri
August, 1963

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Preface

This study represents an attempt to learn more about how, and how much, education brings benefits to people other than students and, indeed, to people other than those in the school district which provides the education. The general approach of the study is as follows: after Chapters 1 and 2, which present the methodology and discuss some conceptual problems, Chapter 3 considers the many forms of social benefits from education, and lays the groundwork for the more intensive analyses and efforts at quantification which follow in Chapters 4-8. In these latter chapters, discussions of benefits at the theoretical level are generally followed by applications to a single case-study community, in an effort to estimate the benefits to other communities from its education, and the benefits to it from education provided elsewhere.

Chapter 9 digresses from the case study to develop and test a statistical model of the determinants of education expenditures -- a model which introduces a measure of external benefits from one area to another. This chapter may be read independently, for its statistical contents do not relate directly to the case study. Finally, Chapter 10 summarizes the quantitative findings for the case study, discusses the relevance of these findings together with those in Chapter 9 for efficiency in resource allocation and equity in educational finance, and concludes with some remarks concerning implications for public policy. Material of a particularly technical sort has been placed in three Appendices.

Comprehension of the main body of this study does not require that they be read. It is hoped that this study will be of interest to educators as well as to professional economists, and in general to all concerned with the over-all functioning of our decentralized system of public schools. To this end, an attempt has been made to minimize the use of technical economic terminology.

In the course of my research I have benefited from discussions with Werner Hirsch and other members of the research group in the Institute for Urban and Regional Studies, Washington University -- Elbert Segelhorst, Morton Marcus and Stanley Berman -- who have been studying the costs of schooling, as part of the over-all investigation of geographical external effects of education of which this study is also a part. The entire study was made possible by support from the Cooperative Research Branch, U.S. Office of Education.

Throughout most of the project period I was fortunate to have the aid of William J. Swift, who served as an efficient and tireless Research Assistant and an effective critic. His contribution was a very real one. Special thanks also go to William Bowen, with whom I discussed a number of aspects of the research, and who commented constructively on early drafts of some chapters and on a later version of the full manuscript. My additional appreciation goes to him and to Frederick Harbison who, as Acting Director and Director, respectively, of the Industrial Relations Section, Princeton University, were most generous in providing secretarial and other services during the year

1962-63, when I was a Research Associate in the Section and Visiting Lecturer in the Department of Economics. Miss Doris McBride and Miss Anne Seitz typed most of a preliminary draft of this manuscript during that year, retaining their cooperative attitudes throughout. During the previous year Mrs. Fay Landau also provided excellent secretarial help, at Washington University. The final typing was handled ably by Mrs. Catherine Mallardi.

The penultimate form of the entire manuscript was read by Edward Denison, Brookings Institution; Bernard Kemp, Center for Naval Analyses; and Thomas Saving, Michigan State University. Chapter 9 was also read by John Brittain, Vanderbilt University; and Richard Musgrave, Princeton University. They all provided extremely useful comments. Data were made available to me, or assistance given in a variety of other forms, by Roald Buehler, Ansley Coale, T. Aldrich Finegan, John Folger, Miss Mildred Kantor, Everett Lee, Francis Llyod, Jr., Charles Nam, David Pittman, Arch Turner, Jr., Donald Yett, and Joseph Pechman and the Brookings Institution.

While my debts are numerous, the full responsibility for the final product is singular.

Burton A. Weisbrod
August 31, 1963

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Chapter 1

Introduction

Individualism has long been a vital part of the American culture. One of its manifestations has been the strong tradition of local control over the system of public education. Historically, each community has determined the variety and amount of schooling to provide its children, and each community has provided the resources for that schooling. Outcomes of these decisions affected essentially only the residents of the community, and so were of little or no relevance to outsiders; at least this seems to have been the theory, and a century or more ago it may not have been far from the fact.

Although these conditions of economic and social isolation were never fully realized, it seems clear that they hold true in a smaller degree now than ever before. The growth of population, increased urbanization, improvements in transportation and in the means of production have brought people closer together. They have also brought about more specialization of economic activity, and with it has come increased economic interdependency.

These developments have affected the independence and isolation of local school districts. To what extent is it true today that the decisions of a community regarding how much to spend on education, how to spend it, and how to finance the spending are matters of concern only to people in that community? This is the general question to be investigated in the present study. More specifically: Who actually receive the benefits created by education -- people within the school district or people outside of it?

Thus, we shall distinguish between those benefits which accrue to persons inside the school district -- internal benefits -- and those which accrue to persons outside the district -- external benefits. These latter, geographically externalized, benefits are termed "spill-overs."

In his Presidential address to the American Economic Association at St. Louis, Missouri in 1910, Edmund J. James said:[1]

> There is no function which has been thus far left or delegated to the locality or to the state more truly national in its scope than is education. The remotest school district in the mountains of Georgia or Tennessee may by great sacrifice support a school in which some of the brightest children of their generation shall be educated, children who on growing to maturity move away into some other district, some other country, some other state, and bring into the particular locality in which they may finally settle all the advantages which this educational process has brought to them. How many of our Western cities have grown strong because of able and educated men who have come into them from the districts of New York or New England! How large a part of the funds of the New England country schools for the last fifty years have gone for the education of men whose contribution to the locality in which they lived and to the nation came not through New England at all, but through Illinois, and Wisconsin, and Minnesota! In fact no one can tell what particular portion of the country will profit most by the fact that the people in some remote school district of Pennsylvania have taxed themselves to the limit for the purpose of training in the best possible way the children of that district. One may safely say that in all probability the chief advantage would rather accrue to some other district than to that which made the sacrifices.

The idea that the benefits of public education are not realized solely by or within the community providing the education is not a new one.

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[1] "The Economic Significance of a Comprehensive System of National Education," Bulletin of the American Economic Association, Papers and Discussions, Fourth Series (April, 1911), pp. 16-17.

The local school district (or community) does not retain all of its students or graduates; it may lose many to the outside world, and receive some from it. Given the sparsely-settled character of the United States during the eighteenth and even nineteenth century, and given the costly, inconvenient, and even dangerous means of transportation, a community was isolated to a considerably greater extent than it is today. Population mobility was never entirely absent, of course, and so spill-overs of benefits of public education have always occurred, but the pace has undoubtedly quickened.

The remainder of this chapter deals largely with theoretical effects of spill-overs of education benefits on the amount of resources devoted to education and on the equity of education finance; it also considers conceptual problems in the analysis of spill-overs, and comments on the policy implications of this study -- a subject which receives additional attention in the concluding chapter.

This study is not a complete analysis of the market for public education. The supply side of the market is not considered at all. Moreover, not even the entire demand side is covered. Demand may be partitioned into two parts -- (1) demand by parents on behalf of their present and prospective school-age children, and (2) all other demand. Only the latter -- demand for the education of other people's children -- is the subject of this inquiry. We are interested here in the benefits from public education to people other than the students and their parents. There seems to be a presumption that such external benefits do exist in some form. For if they do not, then education is merely another private consumption or investment good; and in that case why is it provided publicly? To identify and, where possible, to quantify these external benefits (spill-overs), and to consider their economic effects, are the goals of this study. The more direct benefits of education to students are surely of great importance, but the external benefits have been relatively neglected by economists.

Within the framework of the conventional economic model of profit or utility maximizing behavior, the absence of sizable external effects which are not taken into account by the decision maker is a crucial prerequisite of economically efficient operation of a basically decentralized economy. Insofar as A's decisions affect B without A taking the effect into account, A's decisions are not apt to lead to an optimal allocation of resources. Allocative efficiency will suffer.

And so might equity suffer. If A's decisions injure B while B is not compensated by A, or if B benefits from A's actions without sharing the costs, equity concepts may be violated. They certainly will be if the benefit principle of taxation is deemed "equitable."

Implications of spill-overs for efficiency of resource allocation and for equity of income distribution exist in the public as well as in the private sector. If a community realizes that some of the benefits produced by its expenditures are reaped by persons outside, then it may fail to undertake expenditures which would be desirable from the viewpoint of the entire society. As a maximizer of the well-being of its own present residents, a community would not devote ten dollars worth of resources to produce an output worth eight dollars to them, even though the output were also worth four dollars to outsiders. Thus, a public expenditure producing twelve dollars worth of services at a cost of only ten dollars might not be made.

In this analysis we are postulating a community decision-making unit which tends to equate the marginal costs it bears with the marginal benefits it receives. To the degree that it attempts to maximize its private welfare it will generally behave in a non-socially optimal manner when private and social benefits (or costs) diverge. In general, if marginal social (national) benefits exceed marginal private (community) benefits, we may expect the level of expenditures to be below the optimum. Underinvestment in that commodity or service tends to result. Similarly, deviations of private from social costs tend to result in levels of expenditures which are too low if private costs exceed social costs at the margin, and too high if the opposite is the case. Thus, in principle, society should be concerned about spill-overs of both costs and benefits, though we shall analyze only benefits here.

The non-optimal allocation of resources which may occur as a result of the existence of spill-over effects -- i.e., the allocative-efficiency issue -- is one justification for investigating the spill-over effects of public education. A second justification, as mentioned above, involves the equity issue. Insofar as the benefit principle of taxation is to be applied to education finance, costs should be borne by those who may be expected to reap the benefits. With respect to education there may be very little public support for the application of the benefit principle on an individual basis, but there may be broader support for its use on a community basis. The concept of local responsibility for a community's own education seems to reflect support for the latter notion.

It is important to distinguish between the equity and efficiency questions. A discussion of economic efficiency gives major consideration to the maximization of real income (welfare), given the available inputs, personal preferences, the state of technology, and the distribution of income. Equity discussions, by contrast, focus attention directly on the distribution of income. Thus, while these two issues may be discussed in the same study, and while a given policy will have implications for both, the two issues are logically and analytically distinct.

At this point it is proper to question the assumption that the school district may be viewed as a welfare maximizer. After all, the school district is a political unit the behavior of which is determined largely by voting decisions -- on tax rates and on debt financing. With the inequality of consumer power in the market being replaced by equality of voter power at the polls, the maximization assumption is surely not entirely warranted. But neither is it entirely unwarranted; to some extent those who actually cast votes probably have the greatest stakes in the outcome, so that collective welfare maximization may be approximated through the voting process. Moreover, because of the tendency of people with similar preferences and incomes to cluster in particular communities, decisions based on elections (e.g., on school issues) may not differ greatly from those based on welfare maximization considerations.

The assumption that public education expenditures are made, at least implicitly, with an eye on anticipated benefits -- though not necessarily in monetary form -- can be a useful one. Generally speaking, it is nothing more than the rationality assumption of consumer behavior theory applied to public services. Thus it is assumed that maximization of community welfare is not made impossible by the existence of a political decision making process. Of course, in the last analysis what counts is the predictive usefulness of our results and the insights derived from our analysis, not merely the reality of our assumptions. The reader should remember, in any event, that the effects of spill-overs on resource allocation constitute only one of the two reasons for our interest in them. Even if there were no allocative effects at all, attention to spill-overs would be justified since there would remain the equity effects of existing patterns of education finance.

So far we have referred only to the effects on one community of the spill-overs of its educational benefits to other communities -- its spill-outs; we shall consider now the effects of the spill-ins it receives from other communities. With respect to equity, spill-ins have precisely opposite impacts from spill-outs -- that is, the equity effects of benefit spill-ins and spill-outs tend to cancel each other. But with respect to allocative efficiency, the symmetrical effects of spill-ins and spill-outs may tend to disappear. While spill-outs of benefits tend to diminish expenditures from their optimal level, spill-ins may not bring opposite results. The reason is this: to some extent, a community is to the nation what a purely competitive firm is to the industry; thus, the spill-ins (or imports) of benefits to a community from education provided elsewhere may be largely independent of its own education expenditures. To the extent that they are, the spill-ins constitute fixed benefits; as such they will have no influence on decisions at the margin, assuming community welfare maximizing behavior. Although it is true that spill-outs from one community are generally spill-ins to another, we conclude that the tendency of benefit spill-outs to cause underexpenditure in education does not have its counterpart in a tendency of benefit spill-ins to cause overexpenditure. Total spending on education thus may tend to fall short of optimum.

Let us next examine the assumption in the previous paragraph that the education spill-ins to a community are independent of its own educational activities. If, for example, migration of educated people is considered a form of spill-over of education benefits, then the amount of spill-ins to a particular community through in-migration will be a function of its own education expenditures insofar as some people are attracted to, or repelled from, it because of those expenditures. In this case, the level of spill-ins will not be fixed to the recipient community, but, rather, will be determined by the level and form of its own expenditures. Precisely what proportion of the population has its location decisions influenced significantly by educational considerations is a factual matter, but the smaller the proportion, the more reasonable is the assumption made above that benefit spill-ins are independent of the level of a community's own expenditures. Actually, though, the extreme assumption of complete independence of spill-ins and own expenditures is not necessary for the argument. For spill-overs to exert a net depressant influence on aggregate education expenditures the requirement is only that the location decisions of some migrants be unaffected by the level of education expenditures in the community; the benefit spill-ins accompanying their migration are fixed with respect to education expenditures by the destination community. In Chapter 9 we shall turn again to the effect of benefit spill-overs on the level of education expenditures, at that time developing a statistical model.

As we proceed with our analysis of benefits from education and the inter-community spill-overs thereof, we shall consider implicit as well as explicit (monetary), and social as well as private benefits. In short, we shall try to trace the spatial distribution of the outputs of public education, whether or not these outputs appear in readily identifiable monetary form. It may be useful to restate here the principal questions which this study attempts to answer:

> Are there beneficiaries of public elementary and secondary education other than children and their parents? If so, to what extent are they outside the school district which provided the education? And, to what extent do geographic spill-outs and spill-ins of benefits have offsetting effects -- offsetting with regard to both equity and efficiency in resource allocation?

This study is not intended to demonstrate the desirability or undesirability of any particular public policy toward education. Even if we were able to provide full and final answers to the questions we pose, so that we could demonstrate persuasively that spill-overs of benefits from education are present and quantitatively significant, no policy implications would necessarily exist. First, we cannot be certain if and how the existence of spill-overs actually affects the amount of resources devoted to education -- the allocation issue. Second, even showing adverse allocation effects may be insufficient to justify further dimunition of local control over public education. While making policy recommendations is not one of our objectives, we shall return in the final chapter to the possible policy implications of our findings.

Each step in this study raises numerous procedural questions and requires frequently arbitrary decisions, but it is hoped that the analysis as a whole provided a picture which is of greater significance than the sum of the individual parts. No definitive conclusions are reached here; neither the data nor the logic of the arguments is strong enough to support them. The tentative conclusion is that the traditional economic theory of profit and utility maximization can aid understanding of the economic forces influencing the behavior of at least this portion of the public sector.

Chapter 2

Concepts and Units of Analysis

In order to study spill-over effects of public education, we must select units of analysis: (1) the geographic or spatial unit, and (2) the temporal unit. Then, for the case study application of the analysis we must choose (3) a specific political or other area. This chapter discusses the alternatives and the bases on which the choices were made.

The decision was made to examine the spill-overs for a school district rather than for some other region. There were two reasons. First, the school district is, and long has been, the basic decision making unit; within broad limits it decides how much to spend on public education, in what specific ways, and by what means to finance this spending. Second, the school district is generally a relatively small political unit vis-a-vis the country or a state, and as a result tends to exhibit more spill-over effects. While taking the school district as the basic spatial unit, we shall use the term "community" as a synonym for school district. The two are, of course, not always identical; in rural areas a school district may encompass a number of legal communities, though in urban areas the school district and the community are more likely to be coterminous.

The term, community (school district), has not yet been defined. And the concept is not free of ambiguity. We shall find it necessary to look at the community at different calendar times, and there are alternative ways to view it. Under one definition, the community would be comprised of the (adult) residents of a given geographic area during the period, t, in which decisions on expenditures for education of a particular cohort of children were made. A second definition would consider the community to consist of the residents at t+n, the time during which the benefits from education were being received. A third definition would have the community consist only of persons who resided there at both t and t+n. Adult residents at t who had out-migrated or died by t+n, as well as former non-residents who had in-migrated, would not be considered part of the community when the geographic locus of education benefits was being analyzed. Still other definitions are possible, but it is already clear that the choices are numerous.

We shall use definition 1. We are particularly interested in the effects of benefit spill-overs on the decision process, and so it is appropriate to look at the community as it was constituted at the time the education decisions were considered. Definition 1 is equivalent to definitions 2 and 3, however, if in-migration, out-migration, and deaths between t and t+n are quantitatively negligible relative to the number of continuing residents. (These conditions do not hold for our case study community.)

We have already decided to focus attention on the community demand other than that by parents seeking education of their own children. Parents of public school children have an obvious interest in public schools, and their demand is not likely to be diminished by knowledge that their children may eventually leave the community or even the state. 1/

1/ Eva Mueller, "Public Attitudes Toward Fiscal Programs," Quarterly Journal of Economics, LXXVII (May 1963), p. 231.

The parents may not expect to benefit financially in any case, and to the extent they do, migration by the children may be of no consequence since remittances may still be made to the parents. The parents might even gain financially if the children could obtain greater incomes outside the home community.

But non-parents may also have a stake in education, as we shall see, and their demand for public education (that is, their willingness to support it) may be a negative function of the degree to which potential benefits to them from the schooling of other people's children are lost to outsiders. (At the same time, benefits to outsiders may not be registered as any effective demand for public education in the first community, unless appropriate intergovernmental fiscal arrangements have been made.) Throughout this discussion it should be noted that "non-parents" include all adults other than those who have or expect to have children in public schools. They include older childless people, parents of children who have completed school, and parents of private and parochial school children. Included are even actual or prospective public school parents in their roles as potential demanders (beneficiaries) of public school services for other people's children.

Recent data obtained by the Survey Research Center indicate that support of public education is not limited to parents. Defining an "index value" as the "percent advocating increased spending minus percent advocating decreased spending," and disregarding "no change" answers, the following index values of attitudes toward education were found:[1/]

[1/] Eva Mueller, "Public Attitudes Toward Fiscal Programs," Quarterly Journal of Economics, LXXVII (May 1963), p. 231.

Under 45; No Children	Children Under 18 in Family	Over 45; No Children
64	58	41

As we would expect, the people "Over 45; No Children" had less interest in increasing spending than did either of the other groups, but it it still remarkable that in this older, childless group there was such a large excess of advocates of increased over decreased spending on education. It is at first surprising that support for increased spending was lower among persons with children than among those under 45 without children. However, this finding cannot be evaluated without additional information, at least on the age structures of the two groups. For example, the childless group may be young, on the average, and planning to have children, while the other group may have children nearly through with public school.

The willingness of non-parents to support public education may be diminished if they expect the children in whose education they have invested to leave the area after completing school. In this context the following recent statements warrant quotation, for although they were intended to apply to college and graduate education, they also apply to lower education:[2]

> ...the tremendous mobility...disturbs laymen. He would like some guarantee that the expert [read student] whose schooling he subsidized will give some service to his particular community.

And then,

> ...the layman notices that few of the people who were trained

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[2] Robert Sommer, "Dark Journey Into Expertland," New York Times Magazine, July 28, 1963, p. 20.

in his state university settle in the state, and most of those people working in the state were trained elsewhere. Why, he reasons, should he subsidize this kind of education? It would be more logical for him to subsidize the university outside the state which actually sends its people to his community.

We turn now to the selection of the time unit for the analysis. We shall take the lifetime investment approach, which considers the returns from elementary and high school education over the lifetime of an individual or group. It recognizes that the process of education involves a multi-year investment period, and that the returns (benefits) from the investment are also realized over many years.

The tools which are described and developed below will be used to estimate benefit spill-overs to and from the case study community of Clayton, Missouri. Clayton is adjacent to the city of St. Louis and had a population in 1960 of about 15,000; it is the seat of government of St. Louis County (the suburbs of St. Louis), a county with a 1960 population of about 704,000. The Clayton School District is coterminous with the City of Clayton except that the District includes a small portion of the City of Richmond Heights.

Clayton is an unusual community in many respects which influence its position with respect to education spill-overs. It is a major shopping and financial center for the population of St. Louis County, and has many regional sales offices but no industry. All of these contribute to its property wealth and make possible its high level of public school expenditures of $833 per pupil in average daily attendance in 1959-1960, compared with the national average of $369.[3/] Median family

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[3/] National Education Association, Rankings of the States, 1960 (Washington, 1960), p. 28.

income in Clayton was $10,925 in 1959, 74 percent higher than the median for the entire St. Louis County, $6,275.[4] The median number of years of schooling completed among its persons 25 years old and older, 13.3, was the highest among the 15 municipalities of St. Louis County having populations of 10,000 or more.[5] The comparable level for the United States was 10.6 years.[6] The large number of regional offices of national organizations which periodically transfer personnel contributed to what was probably an unusually high rate of population turnover, although this cannot be documented and although not all of the personnel were residents of Clayton.

It should be emphasized that Clayton is not presented as a typical or representative American community, although it may be reasonably representative of relatively high income suburban communities, at least with respect to spill-overs of education benefits. As we describe the methods of computing benefit spill-overs for Clayton it should become evident how results would vary if a community or region with other characteristics were under consideration.

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[4] David Pittman and Sarah Boggs, "Analysis of Population and School Enrollment Trends in the Clayton School District," (St. Louis: Social Science Institute, Washington University, 1962), ditto, p. 51.

[5] U.S. Bureau of the Census, U.S. Census of Population: 1960, General Social and Economic Characteristics--Missouri, Final Report PC (1)-27C (Washington: Government Printing Office, 1962), Table 73, p. 27-227.

[6] Ibid., General Social and Economic Characteristics--United States Summary, Final Report PC(1)-1C (Washington: Government Printing Office, 1962), Table 76, p. 1-207.

Prior to the choice of Clayton, the decision had been made to study a community within a metropolitan area rather than one which was more physically and economically isolated and which would therefore probably have fewer spill-overs. Clayton, an example of such a community, was chosen primarily because of its proximity, which facilitated data gathering.

To the extent that it is feasible we shall estimate the benefit spill-overs to and from Clayton in monetary terms. When we cannot do so, we shall try to measure benefits in other quantitative terms. When we are unable to do this we shall discuss the spill-overs in qualitative terms. We shall also attempt to say something about the geographic distribution of spill-overs -- the amounts of education benefits which spill out from Clayton to the "core" city of St. Louis, the rest of St. Louis County, the rest of the metropolitan area, the rest of the State of Missouri, and the rest of the nation; and the amounts which spill into Clayton from each of these areas.

Now we proceed to Chapter 3 which takes up the over-all nature of benefits from public education, and the varieties of benefits which are external to the student. It also lays the foundation for succeeding chapters which deal with particular forms of spill-overs. In each of these chapters the discussion in theoretical terms is followed by a discussion of means of imputing market values.

Chapter 3*

The Nature of Education Benefits and Their Spill-overs

Before we can analyze the spill-over benefits of public education we must grasp the nature of the total benefits; only then can we decide which benefits spill over, and in what ways. Thus, the present chapter is in two principal parts. The first, and longer, part discusses the forms of social benefits from education; it includes a discussion of benefits realized by the student and by family members, although our primary concern is with the benefits as seen by persons outside the family. It is not concerned explicitly with the community, and, in fact, it attempts to look at benefits from education far more broadly than is required for the subsequent analysis of geographic external benefits. The second part of the chapter discusses some of the means by which inter-community spill-overs of benefits occur. Both parts deal with their subjects broadly; they leave the intensive analyses to following chapters. We deal with public elementary and secondary education, but many of the findings will be applicable to all levels of schooling, and to private as well as public education.

I

Most economic analysis of returns from education has focused on the contribution of education to earning capacity (and, presumably, to production capacity). While this has been valuable, it is only part of the picture, and perhaps not even a large part. Even aside from those market imperfections which create inequalities between wages and marginal productivity, earnings are an incomplete measure of the productivity of education to the extent that production occurs outside the market.

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*Most of the contents of this chapter first appeared in a paper prepared for a Conference of the National Bureau of Economic Research. The paper, "Education and Investment in Human Capital," was subsequently published with the other Conference papers in a supplement to the Journal of Political Economy, LXX (October 1962), pp. 106-23.

In addition, emphasis on incremental earnings attributable to education disregards external effects. Schooling benefits many persons other than the student and his present family. It benefits the student's future children, who will receive informal education in the home; and it benefits neighbors, who may be affected favorably by the social values developed in children by the schools, and even by the quietness of the neighborhood while the schools are in session. Schooling benefits employers seeking a trained labor force; and it benefits the society at large by developing the basis for an informed electorate. Compulsory school attendance and public (rather than private) support for education in the United States both suggest that external economies from either the production or consumption of education are believed to be important.[1]

From the vantage point of one interested in optimal resource allocation, it is essential to consider all benefits from some action (as well as all costs). Whether the benefits (or costs) involve explicit financial payments, or whether they are internal to, or external from, a particular decision-maker is irrelevant.

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[1] Similarly, but perhaps more clearly, compulsory smallpox vaccination together with public provision of vaccine reflects external economies of "consumption" of the vaccine.

In the private sector of the economy, private benefits from goods and services are reflected in consumer demand; assuming economic rationality, competition, and the absence of external effects, private producers will meet the demand in a socially optimal manner. But when goods and services have significant external effects the private market is inadequate. If the public sector attempts to provide the service, and if consumer sovereignty is to reign, the extent of consumer demand must be judged. It is worth emphasizing that analyzing benefits (or costs) does not preclude specifying which people reap the returns (or incur the costs). In fact, we shall attempt to identify the benefits of education by recognizing the beneficiaries of the education process.

In the discussion which follows, a "benefit" (that is a real benefit) will refer to anything that pushes outward the utility possibility function for the society. Included would be (1) anything which increases production possibilities, such as increased labor productivity; (2) anything which reduces the need to incur costs such as for law enforcement, thereby releasing resources for alternative uses; and (3) anything which increases welfare possibilities directly, such as development of public-spiritedness or social consciousness of one's neighbor. Anything which merely alters relative prices without affecting total utility opportunities for the group under consideration will not be deemed a social benefit (or loss). For example, if expanded education reduces the number of household servants, so that the wage rates of those remaining rise, this rise would not constitute either a benefit or loss from education, but rather a financial transfer between servants and employers. Without making interpersonal utility comparisons we cannot say more. Of course, the increased productivity of those with the additional education is a benefit of type 1.

We turn, now, to the forms of real benefits of education. We begin with an examination of benefits which are realized directly by the student, and then move on to benefits realized by others. One form of benefit to the student is the "financial return" accompanying additional education. A second form is the "financial option" return. Previously unconsidered, this benefit involves the value of the opportunity to obtain still further education. Third are the non-monetary "opportunity options," involving the broadened individual employment choices which education permits; fourth are the opportunities for "hedging" against the vicissitudes of technological change. And fifth are the non-market benefits.

Direct Financial Return

Cencus Bureau data relating level of income to level of educational attainment show an unmistakable positive correlation. A number of investigators have estimated returns from investment in education by attributing these observed income differentials to education.[2] Some have recognized the presence of factors other than education which affect income and which are positively correlated with level of education. These factors include intelligence, ambition, informal education in the home, number of hours worked, social mobility, and family wealth; they lead to the presumption that, in general, persons who have obtained more education would have greater incomes than persons with less education, even without the additional schooling.[3/] At the same time, at least one study has attempted to isolate some of the non-education variables affecting incomes; it found that median salaries rose with additional amounts of post-high-school education, even after adjustments were made for (1) level of high school class rank, (2) intelligence-test scores, and (3) father's occupation.[4/] Apparently at least part of the additional incomes of the more educated population are the results of their education.

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[2] On the relation between educational attainment and earnings see G. Becker, "Underinvestment in College Education?" American Economic Review, Proceedings, L, (May 1960), pp. 346-54; H. S. Houthakker, "Education and Income," Review of Economics and Statistics, XLI (February, 1959), pp. 24-28; H. P. Miller, "Annual and Lifetime Income in Relation to Education," American Economic Review, L (December 1960), pp. 962-86; E. F. Renshaw, "Estimating the Returns to Education," Review of Economics and Statistics, XLII (August 1960), pp. 318-24; W. L. Hansen, "Total and Private Rates of Return on Investment in Schooling," Journal of Political Economy, LXXI (April 1963), pp. 128-40.

Although income or earnings differentials attributable to education may be of considerable significance to the recipients, the social significance depends upon the relationship between earnings differentials and (marginal) productivity differentials. We know that market imperfections

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[3/] See D. S. Bridgman, "Problems in Estimating the Monetary Value of College Education," Review of Economics and Statistics, Supplement, XLII (August 1960), p. 181.

[4/] Dael Wolfle, "Economics and Educational Values," Review of Economics and Statistics, Supplement, XLII (August 1960), pp. 178-79. See also his America's Resources of Specialized Talent (New York: Harper & Bros., 1954); and Wolfle and Joseph G. Smith, "The Occupational Value of Education for Superior High School Graduates," Journal of Higher Education, 27 (1956), pp. 201-13.

may make earnings a poor measure of one's contribution to output, and that in a growing economy cross-section age-earnings data will understate future earnings. One writer has suggested that older workers may receive more than their marginal productivity because status and seniority rules maintain wages while productivity is falling.[5/] But even assuming that earnings equal current marginal productivity, estimation of lifetime productivity from cross-section earnings data tends to understate future productivity of today's young workers; this is true because in a growing society each new cohort of people into the labor force comes with better education and knowledge. These two examples suggest that the observed current earnings of men are less than fully satisfactory as reflections of future marginal productivity. Much work remains before we can feel confident of our ability to measure adequately the influence of education on productivity. Perhaps more serious, because apparently it has not been recognized, is a methodological limitation to previous estimates of the financial return to education. We turn to this now.

Financial Option Return

Given our interest in resource allocation, we should like to know what financial return from additional education a person can expect. It

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5/ Mary Jean Bowman, "Human Capital: Concepts and Measures," in Selma J. Mushkin (ed.), Economics of Higher Education (hereinafter cited as "Higher Education") (Washington: U.S. Government Printing Office, 1962), p. 86.

was suggested above that income differentials associated with education-attainment differentials would have to be adjusted for differences in ability, ambition, and other variables before we could isolate the education effects; and that an adjustment for systematic differences between earnings and productivity would also be required. Let us assume that these adjustments have been made and that we have computed the present values of expected future earnings of an average person with j and k years of education, ceteris paribus; it is our contention that this would be an erroneously low estimate of the gross return which may be expected from the additional education.

The value of additional education may be thought of as having two components: (a) the additional earnings resulting from completion of a given level of education (properly discounted to the present, of course), and (b) the value of the "option" to obtain still further education and the rewards accompanying it. Thus, for example, a decision to obtain a high-school education involves not only the likelihood of obtaining the additional earnings typically realized by a high-school graduate but also involves the value of the opportunity to pursue a college education.[6/] The value of the option to obtain additional education will tend to be greater the more elementary the education. For the "highest" level of

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[6/] Research by Jacob Mincer suggests that additional schooling also provides opportunities to obtain additional on-the-job training (see his "On-the -job Training: Costs, Returns, and Some Implications," Journal of Political Economy, Supplement, LXX (October 1962), pp. 50-79, especially Table 1. The value of this opportunity should be included in the financial option approach developed here.

formal education, the value of the option is clearly zero, except insofar as the education provides the option to pursue independent work.

The option-value approach attributes to investment in one level of schooling a portion of the additional return over cost which can be obtained from further education -- specifically, that portion which is in excess of the opportunity cost rate of return.[7] Although part of the return from college education is indeed attributed to high-school education, there is no double-counting involved. In fact, the procedure is the same as that involved in the valuation of any asset, where the decision to retain or discard it may be made at various times in the life of the asset. Consider the following case: a machine is offered for sale. The seller, anxious to make the sale, offers an inducement to the buyer in the form of a discount on the purchase of a replacement machine when the present one wears out. Analyzing the prospective buyer's current decision, we see that he is being offered a combination of (1) a machine now, and (2) a discount (or option) "ticket" for possible future use. Both may have value, and both should be considered by the prospective buyer.

Let us assume that the machine has been purchased and used, and the owner is now deciding whether he should buy a replacement. Needless to say, the rate of return expected from the prospective machine will be a function of its cost net of the discount. The profit-maximizing buyer will compute the rate of return on the net cost and compare it with the opportunity cost of capital. Thus, in a real sense, the discount ticket has entered into two decisions: to buy the original machine and to buy the replacement. But this is not equivalent to any erroneous double-counting.

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[7] For an algebraic presentation of the method for computing the option value of various incremental levels of schooling, see Appendix C.

The machine discount-ticket analogy also makes clear the point that the value of the option (or discount) cannot be negative. If a greater rate of return is available elsewhere, the value of the option merely becomes zero, as long as it need not be used. Thus, as long as a high-school graduate need not go on to college the value of the option to go cannot be negative. It is formally conceivable, however, that a positive option value of elementary-school education could consist of a negative value for the high-school component and a larger, positive value for the college component.

The value of the option to pursue additional schooling depends upon (1) the probability of its being exercised and (2) the expected value if exercised. In the absence of further information, factor 1 may be estimated by the proportion of persons completing a particular level of education who go on to a higher level. The expected value of the option if exercised, factor 2, is any excess of the return on that increment of education over the return obtainable on the best comparable alternative investment.

If the option value of education has been overlooked by parents, as it has been by economists, there would be a tendency toward underinvestment in education. If time horizons are short so that, for example, a prospective high-school student and his parents sometimes fail to consider that a few years later the child may wish he could be going on to college, there will be a systematic downward bias to the valuation of education by individuals.

The words "option" and "opportunity" have appeared repeatedly in the discussion above. Indeed, it seems that in many respects the value of education is a function of the additional options which become available to a person having it -- job options, income-leisure-security options, additional-schooling options, on-the-job learning options, way-of-life options.

Recognizing the existence of such options suggests a possible means of estimating the monetary equivalent value of non-monetary returns from certain education. Thus, the college graduate who chooses to go to graduate school and then enter academic life may be assumed to obtain a total (not merely monetary) return on his graduate education costs at least equal to what he could have obtained from a comparable alternative investment. In general, added education widens the variety of job opportunities, and to some extent people with more education may choose employment which provides additional non-monetary rewards, such as greater security, perhaps even at the expense of an actual reduction in monetary rewards. To the extent that this is so, and that knowledge of alternatives exists, previous estimates of the individual returns to education, utilizing incremental income or earnings figures for people with two different levels of education, have had a downward bias. If monetary returns from, say, graduate education turn out to be less than comparable alternative returns, the difference would be a minimum measure of non-monetary returns, though not necessarily of the employment-associated return alone. This assumes that such differences are the results of different opportunities or preferences, not of different abilities unconnected with education.

"Hedging" Option

There is another respect in which education provides a person with options: the increased ability to adjust to changing job opportunities. With a rapid pace of technological change, adaptability (which may be a noteworthy output of additional education) becomes important. Education may be viewed as a type of private (and social) hedge against technological displacement of skills. New technology often requires new skills and knowledge; and those persons having more education are likely to be in a position to adjust more easily than those with less education, and to reap the returns from education which the new technology has made possible. This line of reasoning suggests that a more general academic curriculum is desirable since it permits greater flexibility than a curriculum which requires earlier specialization.

Insofar as the return resulting from greater flexibility is realized in the form of earnings, it will be reflected directly in the estimated monetary value of education. The hedging option has additional value, however, to the extent that people have a preference for greater security and stability of earnings.

The hypothesis that added schooling develops added labor-force flexibility and thereby facilitates adjustments to changing skill requirements suggests the following implication: the higher the level of an individual's formal education attainment, the more he can benefit from additional on-the-job training, and, therefore, the more on-the-job training he will obtain. Jacob Mincer's data support this view;[8] through time, investment in learning on the job is increasingly being concentrated on persons with education beyond elementary school. He estimates that in all three years, 1939, 1949, and 1958, on-the-job training costs per person were positively correlated with the level of education. Moreover, a trend is observable -- in 1939, on-the-job training costs per person with elementary education were 38 percent of costs per college-educated person; in 1949 they were 30 percent; and by 1958, 28 percent. Over the twenty-year period, training costs per capita for elementary-educated persons actually declined (in constant dollars), while they climbed 13 percent for college-trained persons.

Non-Market Returns

So far we have discussed the return to education which is realized by the individual in terms of his employment conditions. But some of the value of education to the individual accrues in other forms. For example, the fruits of literacy -- an output of elementary education -- include, in addition to consumption aspects, the implicit value of its non-market use. To illustrate: when a person prepares his own income tax return he performs a service made possible by his literacy. Were this service provided through the market, it would be priced and included in national income.[9]

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[8] Op. cit., Tables 1 and 2. But E. F. Renshaw predicts that the principal educational requirements of the 1960's, with respect to the labor force, will be directed toward trade schools and apprenticeship programs ("Investment in Human Capital" [unpublished manuscript, 1960], p. 13).

Assume that roughly fifty million of the sixty million personal income-tax returns filed per year are prepared by the taxpayer himself.

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[9] It could be argued that the service (like many others in national income and product) is not a final output, but a cost item (cost of tax collection), and thus should not be included in estimates of production; but since it is often difficult to distinguish clearly outputs from inputs in our national accounts, and since our national income and product accounts principally measure effort expended, it would be interesting to make some estimate of the market-value equivalent of the services performed by a person in preparing his own income-tax-return.

Inclusion of the value of this non-market production as an educational benefit presupposes that this represents a net increase in the value of the individual's total non-market activities and that the opportunity cost of performing additional non-market production is essentially zero.

Richard Goode has suggested in correspondence that, although the failure to consider non-market production leads to understatement of the return to education, "nevertheless, there seems to be little danger that this omission will lead to an undervaluation of educational benefits in comparing time periods, countries, and population groups with different amounts of formal education." He presents "the hypothesis that the greater the amount of formal education the greater the proportion of goods and services acquired through the market. If this is true, estimates based on money earnings or national income statistics may exaggerate the contribution of education to real income differentials or growth."

At a value of $5.00 per return, a low estimate of an average charge by an accountant for preparing a not-too-complex return, we arrive at an annual market value of the tax-return services performed by taxpayers for themselves of $250 million. Relative to T. W. Schultz's estimate of total elementary-school costs of $7.8 billion in 1956,[10] this suggests a current-year return of 3.2 percent of the current investment in literacy. And this is only one, obviously minor, form of return from literacy which the individual enjoys.

This attempt to place a value on a particular use of literacy is subject to at least the following criticism: were it not for the widespread literacy in this country we would probably not have the present type of income-tax system operating, and, therefore, we would adjust to illiteracy in a less costly way than having others (say, accountants) prepare tens of millions of returns. The adjustment might involve government tax assessments or a resort to another type of tax such as one on expenditures. Therefore, the literacy value estimate presented above is on the high side, in terms of the alternative tax collection cost in the absence of literacy.

A very rough estimate has been attempted of the cost of collecting an alternative form of tax -- a sales tax -- which would not require such a literate population, in order to compare it with the collection cost of the income tax. In doing this we do not imply that the two taxes are equally "good"in terms of their distributional or allocative effects. The assumption is that a principal reason for the relative tax-collection efficiency of the income tax is the work performed by the taxpayer in preparing his own return. For the year 1940, the all-states average cost of collecting state personal income taxes was $1.50 per $100 collected, while the comparable figure for the states' general sales taxes was $2.00 per $100 collected. In the same year, collection costs per $100 of federal personal income tax were estimated at $1.68,[11] while there was no federal sales tax.

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[10] "Education and Economic Growth," *Social Forces Influencing American Education* (hereinafter cited as "Economic Growth") (Chicago: National Society for the Study of Education, 1961), p. 64, Table 3.

In the absence of a superior alternative we have assumed that a federal sales tax would cost one-third more to collect than the federal personal income tax, the same relationship as held for the states' sales and income taxes. Assuming the 1960 Internal Revenue Service estimate of collection costs, approximately forty cents per $100, to apply to the personal income tax, then a one-third increase in the cost of collecting $50 billion (1959 individual income-tax receipts) would involve an additional

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[11] James W. Martin, "Costs of Tax Administration: Statistics of Public Expenses," Bulletin of the National Tax Association, 29 (February 1944), pp. 132-47, as cited in Charles A. Benson, The Economics of Public Education (Boston: Houghton-Mifflin Co., 1961), p. 143.

Estimation of collection costs is subject to the common difficulty of the allocation of joint costs; furthermore, we really know little about scale economies in tax collection, or about the difference in degree of enforcement of state and federal taxes, so that it is dangerous to apply state cost figures to the federal level.

$66 million -- approximately 0.8 percent of elementary school costs.[12]

We may now turn to the benefits of education which are external to the student. If all benefits of education accrued to the student, then, assuming utility-maximizing behavior and access to capital markets, there would be little reason for public concern about the adequacy of education expenditures -- unless publicly supported education were an efficient way of altering the personal distribution of income in a desired way.

Income redistribution effects aside, it seems clear that access to the capital market is imperfect and also that a child, even at high-school or college age, is in a poor position to make sensible long-run decisions regarding the amount or type of education, though advice from teachers, counselors, and parents may improve the decision. But these imperfections hardly appear to explain the massive public expenditures in support of education -- more than $19 billion in 1960, including capital outlays.[13] We are led to the position that to understand why education is of public concern as well as to project demand for education and to determine whether expanded education is warranted on allocative-efficiency grounds alone, we should pay more attention to identifying and quantifying external benefits of education.[14] This section of the chapter suggests a framework for analyzing these benefits and considers opportunities for measurement.

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[12] Actually we should note that a number of years of education is required to develop "literate" people but also that, once developed, they presumably retain the knowledge. Were we to take into account the number of tax returns an average person may be expected to file during his lifetime, a higher rate of return would appear.

[13] U.S. Department of Health, Education, and Welfare, *Health, Education, and Welfare Trends, 1961* (Washington: U.S. Government Printing Office, 1961), pp. 32, 33.

As economists, our interest in external benefits is typically related to the question of whether all benefits (as well as costs) of some action are taken into account by the decision-maker. The issue is whether the benefits are or are not captured by the decision-maker, since the assumption of utility or profit maximization is ordinarily interpreted to imply that benefits will be recognized by the decision-maker if, but only if, he is able to obtain them. Insofar as parents and children make joint decisions on purchases of education, with some of them being a very expert, experienced buyer, those benefits which are less apparent and indirect are likely to be overlooked. Parents thinking of their children may even neglect the less direct benefits to themselves, discussed below. Moreover, benefits to nonfamily members are probably not considered at all.

In principle, the recipients of external benefits from some activity (for example, education) should be willing to subsidize the activity and, indeed, should seek to subsidize it. The voting mechanism and taxation provide the means for subsidization. Analysis of voting behavior may shed some light on the question of whether external benefits are recognized and have an effect on decisions. But regardless of whether or not subsidies are actually paid by "outsiders," we need to identify and measure the magnitudes of external benefits to determine the returns on resources devoted to education.

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[14] It is true, however, that economies of scale (with respect to the number of students) would also be a sufficient explanation for the public interest in education.

Persons receiving external benefits from a student's education may be divided into three broad groups, though the same people may be in more than one: (1) residence-related beneficiaries -- those who benefit by virtue of some relationship between their place of residence and that of the subject; (2) employment-related beneficiaries -- those who benefit by virtue of some employment relationship with the subject; (3) society in general.

Residence-Related Beneficiaries

Current family of the subject. While the purpose of schooling is obviously education, the manner in which it is provided may result in incidental, even accidental, but nevertheless valuable, by-products; in the case of elementary education, such a by-product is child care. Schools make it possible for mothers who would otherwise be supervising their youngsters to do other things. For those mothers who choose to work, we have an estimate of the productivity of the child-care services -- their earnings. This rests on the assumption that the mothers would not work if a sitter had to be hired but do work when the child is in school. If mothers would make other child-care arrangements in the absence of schools, then a better measure of value than earnings-obtained would be the cost of hiring a baby sitter or making some alternative custodial arrangement.

In March 1956, there were 3.5 million working mothers in the United States with children six to eleven years of age.[15] Assuming that as few as one million of these mothers would not work except for the schools (the others being willing to let their children stay with hired persons or other members of the family or friends, or simply to care for themselves), and assuming $2,000 as the earnings of each mother during the school year, the value of the child-care services of elementary school may be estimated as roughly $2 billion per year.[16] Estimating total resource costs (excluding capital outlays but including implicit interest and depreciation) of public and private elementary schools in 1956 at $7.8 billion,[17] we reach the startling conclusion that elementary-school support provided a return of 25 percent of cost in the by-product form of child-care services, alone.[18] This disregards the value of these services to mothers who do not choose to work; since the value is certainly greater than zero, the total value of the child-care is even more than 25 percent of cost.

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[15] U.S. Bureau of the Census, *Marital and Family Status of Workers: 1956*, Series P-50, No. 73 (Washington: U.S. Government Printing Office, April, 1957), Table 3, p. 11.

[16] For those mothers who would be willing to hire baby sitters, obtainable for, perhaps, $1,000 per year, the value of the school-child-care services is this alternative cost of $1,000, instead of $2,000. Of the 3.5 million working mothers with children six to eleven years old, approximately 1.5 million also had children twelve to seventeen. Some of the older children could conceivably care for the younger ones; but even considering the remaining 2 million, the assumption that one-half would not work except for the care provided by schools seems plausible and even conservative.

[17] Schultz, "Economic Growth," p. 85.

[18] If working mothers employ housekeepers as substitutes and if they incur other additional costs in working (for example, transportation and additional clothes), these added costs should be deducted from the gross returns.

The increased production from working mothers tends to offset the foregone production from students in school. Various writers have emphasized students'foregone earnings as a cost of education, and have debated its magnitude, but have not considered the fact that some mothers' earnings are made possible by the fact that children forego earnings to remain in school. Of course, while these benefits of education are external to the student, they are internal to the current family unit.

Future family of the subject. When the student reaches adulthood and becomes a parent, the children will benefit from his or her education by virtue of the informal education which the children receive in the home. The presence and relevance of such education is recognized, but no attempts to estimate its value have been made. If scores on achievement tests could be related to educational attainments of parents, adjusting for variation in students' ability, we might obtain some information about the extent of education in the home. This might be translated into equivalent years in school, to which a value, perhaps average cost, could be attributed.

If we think of the investment-consumption distinction as involving whether or not benefits accrue in the "present" (consumption) or in the "future" (investment), then education has an investment component in the form of these intergeneration benefits.[19/] If we generalize the conception

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[19/] Schultz has also recognized this point: "The education of women... reduces the subsequent effective costs of education because of the critical of investment to include not only intertemporal benefits,[20] but also interpersonal benefits, then the child-care role of schools, discussed above, represents an investment in the productivity of mothers. Similarly, other interpersonal benefits examined below will constitute investment aspects of educational expenditures.

Neighbors. As we consider more extended groups, beginning with the individual receiving the education and then his family (present and future), we come to his neighbors. Education affects them at least in the following ways: by inculcating acceptable social values and behavior norms in the community children and by providing children with alternatives to unsupervised activities which may have antisocial consequences. The second is essentially of short-period significance -- during the time the child is of school age. The first effect is clearly of long-period consequence, following the student as he grows, and as he moves. As the student achieves adulthood, and as he migrates, the social values developed in part through his education continue to affect his "neighbors."[21]

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[19] (Cont'd)
role that mothers play in motivating their children to obtain an education and to perform well while they are attending school. Thus, if we could get at the factors underlying the perpetuation of education, it is likely that we would discover that the education of many persons not in the labor force contributes heavily to the effective perpetuation of the stock of education. To the extent that this is true, some part of the education not in the labor force contributes to this investment process." ("Economic Growth," *op. cit.*, pp. 74-75.)

[20] Tax implications of the existence of intertemporal education returns have been discussed by R. Goode, "Educational Expenditures and Income Tax," in Mushkin (ed.), *Higher Education*, pp. 281-304.

[21] One writer points out: "Education has effects on the caliber of voluntary community activities: choral groups, drama clubs, local art shows, etc." (Benson, *op. cit.*, p. 349.)

The hypothesis that education does affect neighbors might be tested by studying voting behavior on school issues among non-parents. We might hypothesize that their voting would be influenced by the extent to which students emigrate after completion of school, so that any potential external benefits (or costs) to neighbors would be realized by persons in other communities. Perhaps some notion of the magnitude of external, neighborhood benefits -- at least to the extent they are recognized -- could be obtained in this manner.

Taxpayers. Related to the effects of education on neighbors are the effects on those who pay (directly or indirectly) for the consequences of the lack of education. For example, insofar as lack of education leads to employment difficulties and crime, law enforcement costs will tend to be high. Thus may education provide social benefits by reducing the need for incurring these "avoidance costs," to the advantage of taxpayers.

Education also benefits taxpayers in other communities. The migration of poorly educated persons having behavioral patterns and educational attainments differing from those prevailing in the new areas may necessitate additional effort and expense to permit the in-migrant children to adjust to the new school conditions.[12] Thus, people in areas of in-migration have a stake in the education of children in the areas of out-migration. People who are or may be in the same fiscal unit with an individual have a financial stake in his education.

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[12] See, for example, C. F. Schmid, V. A. Miller, and B. Abulaban, "Impact of Recent Negro Migration on Seattle Schools," *International Population Conference Papers* (Vienna: Union International pour l'Etude Scientifique de la Population, 1959), pp. 674-83.

Employment-Related Beneficiaries

The education of one worker may have favorable external effects on the productivity of others. Where production involves the cooperative effort of workers, flexibility and adaptability of one worker will work to the advantage of others. Productivity of each member of the group influences the productivity of each other member. In such a case, each worker has a financial interest in the education of his fellow workers. The relevance of this interdependence for the present context rests on the assumption that education develops the properties of flexibility and adaptability. Further study is required to determine the extent to which the assumption is valid, and if it is, to estimate its significance.

Employers may also have a financial interest in the schooling and training of their employees. Much of education improves the quality of the labor force and thereby bestows some benefits to employers of the workers insofar as market imperfections or the "specific"[22] nature of the education result in failure of the employer to pay the worker his full

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[22] As the term is used by Gary S. Becker "specific" training is that which rises the marginal productivity of the worker in one firm more than it raises his productivity in other firms. By contrast, "general" training raises marginal productivity equally in many firms. Since, under competitive conditions, wage rates are determined by workers' marginal productivities in other firms, a worker with "specific" training would be expected to receive a wage less than his actual marginal revenue productivity but more than his alternative productivity. Becker, "Investment in Human Capital: A Theoretical Analysis," *Journal of Political Economy, Supplement*, LXX (October, 1962), pp. 9-49.

(marginal revenue) productivity. Under perfectly-competitive conditions, short-run advantages to employers would become benefits to consumers or resource owners in the long run.

Society in General

We have seen that some of the benefits from education are enjoyed by individuals and groups that are reasonably identifiable. But some of the benefits are distributed broadly either spatially or temporally, so that the nature of individual beneficiaries is obscure. These shall be considered under the heading, "Society in General," which thus becomes somewhat of a residual category of benefits. Literacy has social value beyond its value to the individual possessing it and to employers. Without widespread literacy the significance of books, newspapers, and similar media for the transmission of information would dwindle; and it seems fair to say that the communication of information is of vital importance to the maintenance of competition and, indeed, to the existence of a market economy, as well as the maintenance of political democracy. The American voting process would be seriously impaired by widespread illiteracy.

Along the same lines it should be noted that the substantial role played by checking deposits in our economy requires, among other things, generalized literacy and competence with arithmetic operations. It is not necessary to argue the issue of cause versus effect, but only to recognize the essentiality of literacy -- a principal output of elementary education -- to the present state of our economic development. Nor does saying this deny the possibility that other factors were also indispensable to growth.

Equality of opportunity seems to be a frequently expressed social goal. Education plays a prominent role in discussions of this goal, since the financial and other obstacles to education confronted by some people are important barriers to its achievement. If equality of opportunity is a social goal, then education pays social returns over and above the private returns to the recipients of the education, although there may be some private costs to previous holders of privileged positions.

Although the long-term effect of education on future earnings is surely the most powerful income distribution consequence of education,[24] there are also some short-term effects. These occur through the provision by schools of things traditionally considered to be private consumer goods and services -- including subsidized lunch programs, musical instrument lessons, and driver-training courses.

Training of persons in particular kinds of skills may result in important external benefits if there are bottlenecks to economic development. In the context of underdeveloped economies, one writer, while particularly noting the political significance of primary and higher education, and the prestige significance of the latter, argues: "Secondary education is essential to the training of 'medium' personnel

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[24] The relation between education and income distribution has been studied by J. Mincer, "Investment in Human Capital and Personal Income Distribution," _Journal of Political Economy_, LXVI, (August, 1958), pp. 281-302 and L. Soltow, "The Distribution of Income Related to Changes in the Distributions of Education, Age and Occupation," _Review of Economics and Statistics_, XLII (November, 1960), pp. 450-3.

(elementary teachers, monitors, officials, middle classes). The shortage of such people is today a real obstacle to economic development."[23] But without perfect capital markets and appropriate subsidization programs, these socially valuable people may be unable to capture for themselves the full value of their contribution. Therefore, their earnings would understate the full social benefits of their education. On the other hand, there are surely cases in which education brings differentials in income which exceed the differentials in social marginal product.

We might summarize our findings. Some of the benefits of education are realized at the time the education is being received (that is, in the "short" run); others, after the formal education has been completed (that is, in the "long" run). Benefits to mothers, in terms of the child-care role of schools, and benefits to neighbors, in keeping children "off the streets" are realized while the education is being obtained. Any benefits associated with subsequent employment of the student as well as benefits to the student's future children are realized later.

We have found, further, that benefits from education occur not only at various times but also in various places. The benefits of education do not necessarily accrue to people in the area or in the school district which financed the child's education. In particular, some of the benefits depend upon the individual's place of residence, which may change. Location of many residence-related benefits as well as employment-related benefits will be determined partly by population migration, though this is not generally true of benefits to family members and to society as a whole. While it is not necessarily true that total benefits will depend upon one's location, the point is that the particular beneficiaries will be a function of the location of the individual. Thus, the process of migration is a process of spatial shifting of some of the external effects of education.

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[23] Michel Debeauvais, "Economic Problems of Education in the Underdeveloped Countries," in International Association of Universities, *Some Aspects of Educational Development in Europe* (Paris: International Universities Bureau, 1961), pp. 116-17.

Some interesting questions are raised simply by the recognition that external benefits of education exist, and that they are not all in broad, amorphous form; that is, that to some extent these benefits accrue to particular, rather well-defined, groups. Thus, to the extent that the education system at the elementary level is producing child-care services as an output, benefit-principle taxation would suggest that families of the children might pay for these benefits.[26] In general, a desire to use this taxation principle would imply attempts to identify various groups of beneficiaries to assess taxes in recognition of the functional and geographical distribution of benefits. In pointing this out, there is no attempt to argue that the benefit principle, in contrast to the ability-to-pay or some other principle, should prevail.

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[26] This point came out in a discussion with Julius Margolis.

It seems that there is a legitimate question concerning the justice of requiring broad, public support for education insofar as the benefits are narrow and private, except as an income-redistributive device. For example, to the extent that there is really no educational sacrifice involved in having children attend split-shift classes, so that the real motive for the abolition of split-shifts is to make life more comfortable for mothers who have all of their children in school at the same time, then a question of equity arises: should non-parents be expected to share the costs associated with the provision of these child-care services for parents? The answer may not be an unequivocal "no," but the question deserves further consideration. Except for lack of information, or a total disavowal of benefit-principle taxation, there is little rationale for failure of our education-tax system to recognize the existence of particular groups of beneficiaries.

There is another strong reason for identifying benefits and beneficiaries. To the extent that the distribution of tax burdens for the support of education differs substantially from the distribution of education benefits, it is likely that education will be either undersupported or oversupported from an allocative-efficiency standpoint, given the existing preference structure and distribution of income and wealth. At the same time, one objective of education policy may be to change the distribution of income.

Both with respect to equity and allocative-efficiency in education, the phenomenon of migration needs to be recognized. Insofar as some of the benefits of education depend upon the location of the individual and insofar as this location is a variable over his lifetime, some of the benefits from education accrue to people who have played no part at all in the financing of this particular person's education. This would seem to be especially pertinent with respect to areas of substantial net in-or-out migration. On benefit-principle grounds, areas experiencing net in-migration might be expected to subsidize educational activities in areas of net out-migration, particularly if highly productive people were involved, and even if their productivity would have been lower in the origin area. Subsidy in the opposite direction might be justified insofar as the in-migrants to an area are relatively unproductive compared to its out-migrants. Needless to say, there are good and powerful arguments in favor of financing education at a local level. However, a thorough analysis of the issue would seem to require recognition of the points raised here.

The analytic approach to benefit identification employed in this section is one of many alternatives; it does appear to have the advantage of focusing on the time and location dimensions of education benefits, and these are relevant to the study both of efficiency in the allocation of resources between education and other ends, and of equity in the financing of education.

It is clear that even with much additional effort we shall be unable to measure all the relevent benefits of education. At the same time the following three points are worth noting, and they summarize the views expressed in this section: (1) identification of benefits is the logical step prior to measurement and, therefore, recognizing the forms of benefits represent some progress; (2) determination of what it is we are trying to measure will make it easier to develop useful quantification methods; (3) some reasonable measures of some education benefits are possible.

II

Aside from the effects of school tax shifting, are there any economic reasons why the quantity and quality of education provided by some community should be of interest to "outsiders?" Such interest would exist if, among other possibilities, (1) outsiders' productivity or employment prospects were affected by the level of productivity of persons educated elsewhere; or (2) outsiders' tax burdens were affected by the level of welfare payments to persons educated elsewhere. This division is between "real," or technological, effects, and "pecuniary," or transfer, effects. As one example of the latter, consider this case: community A provides high quality education, and as a result unemployment rates among its former students are low. Community B, in the same state, may benefit insofar as unemployment in the state is lower than it would otherwise be (that is, insofar as some unemployment is "structural"), and thus smaller unemployment compensation taxes and relief payments are needed. These reductions in unemployment and welfare payments are not additional "real" gains to society as a whole; they are reductions in transfer payments from B to A. But to the outsiders, B, they are benefits from A's expenditures on education.

Transfer benefits are not limited to persons in the same state. Migration brings into a common fiscal unit people educated in various parts of the country; in this way, too, the adequacy of schooling provided in one area may subsequently affect persons who had been "outsiders." Thus, under existing fiscal structures many outsiders share in the financial burdens resulting from inadequate education -- that is, share the financial benefits of adequate education. And so they have a stake in the educational activities of other communities -- on behalf of people they may never meet. (This is discussed further in Chapter 7.)

Many of the spatial spill-overs we discuss occur through migration. Educational capital is embodied in people; thus the returns from this investment occur as the individuals use the capital, wherever they may be located. If the community regards its aggregate income as something to be maximized, and if education has contributed to that income, then loss of income accompanying out-migration of persons educated locally is a loss of one of the benefits from public education (Chapters 4 and 5). The severity of the loss cannot be specified, however, without knowledge of the community welfare function.

Even if a community does not regard out-migration as the cause of loss of the entire incremental earnings stream generated by education, it may be concerned with the loss of the tax revenue portion of those earnings (Chapter 6). Relatively few communities have explicit taxes on income,[27] but most if not all do tax real or personal wealth, and greater income is likely to lead to greater wealth.

In addition to the spill-overs of monetary benefits, there may be spill-overs of non-monetary, non-market, benefits of education. For example, people with more education are likely to make larger contributions of their own labor to civic and charitable causes,[28] and to be community leaders. We do not want to value the productivity of these services at zero simply because they may be unremunerated. If the education caused the increased willingness or ability to undertake these non-market activities then the out-migration of such public spirited persons from the community in which they were educated is a spill-out, or export, of education benefits.[29] The origin area produced benefits realized by the destination area.

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[27] Actually, as of July 1, 1960, municipal income taxes were levied in only five states -- Kentucky, Ohio, Pennsylvania, Missouri and Alabama. In each of the latter two, only one community had such a tax -- St. Louis and Gadsden. In Kentucky, ten communities levied income taxes; in Ohio, the number was sixty-one, of which fifty-one had populations under 50,000. Municipal income taxation was most widely used in Pennsylvania, where it originated; income taxes were imposed by thirty cities; 240 boroughs, 40 townships, and 800 school districts. (Advisory Commission on Intergovernmental Relations, Local Nonproperty Taxes and the Coordinating Role of the State (Washington: U.S. Government Printing Office, 1961), Table 19, p. 38.

[28] See footnote 21.

[29] It is possible that the people who go to school longer would be more public-spirited even if they had not obtained the additional education. If so, the education would not cause the observed non-market contributions by better-educated people.

In the following chapters only a few of the education benefit spill-overs we have discussed will receive additional attention. Some of the estimation procedures employed represent frankly groping attempts to measure things that are frequently deemed unmeasurable. At best the attempts are partially successful.

Chapter 4

Production and Spill-Overs of Educational Capital

One of the benefits from education is increased income. This income is realized by the individuals receiving the education, and so if these persons leave the community in which they were educated they take their "educational capital" (the increased income generated by education) with them. To what extent does a community suffer when persons it has educated leave, and to what extent does it gain when persons educated elsewhere move in? These are the major questions to be discussed in this chapter.

I

Consider four means by which a community might benefit financially from education, and the effects of migration on the geographic locus of benefits.

1. Direct Income Effects. Since education appears to raise labor productivity and income,[1] education will tend to increase aggregate community income, provided that the "educational capital" remains in the community. Other individuals in the community might wish to see total community income (as distinguished

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[1] Gary Becker, "Underinvestment in College Education?," *op. cit.*, pp. 346-54; H. S. Houthakker, "Education and Income," *op. cit.*, pp. 24-28; Herman P. Miller, "Annual and Lifetime Income in Relation to Education," *American Economic Review*, L (December, 1960), pp. 962-86; and W. Lee Hansen, "Total and Private Rates of Return to Investment in Schooling," *op. cit.*, pp. 128-40.

from per capita income, or as distinguished from the incomes of certain persons in the community) maximized even if the individuals' own incomes are not raised. The motivation to maximize community income, subject to a minimum individual income constraint, appears to be analogous to the alleged motivation by firms to maximize sales subject to a minimum profit constraint.[2] In the former case the increase in community income resulting from the education of a person is, by definition, a community benefit, realized to some extent by all persons in the community, not merely by the particular persons whose money income rises.[3]

In estimating the loss to a community from out-migration of educational capital, the question arises as to whether the loss is the expected additional productivity (earnings) or simply the cost of the education. The latter will be a smaller figure, at least for young people, since evidence exists that education pays a positive rate of financial return.

If an asset can be replaced, the value of that asset might well be measured by replacement cost; but an irreplacable asset would better be valued by the present worth of its future net income stream. These generalizations hold for human as well as non-human resources. Replacement of the educational value embodied in an out-migrant may be brought about through in-migration; thus if out-migration leads to, or permits, the in-migration of a person with comparable educational capital who would not otherwise have in-migrated, then the only loss involved is any cost associated with obtaining the replacement -- e.g., advertising. This is the situation for a community which "cannot" expand and to which people wish to move but cannot unless someone else moves out.

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[2] The latter motivation is hypothesized by William J. Baumol in his Economic Theory and Operations Analysis (New York: Prentice Hall, 1961), pp. 192-205.

[3] For another study suggesting that increased aggregate income is a benefit to a community, see James R. Rinehart, "Rates of Return on Municipal Subsidies to Industry," Southern Economic Journal, XXIX (April, 1963), pp. 297-306.

But such a community or region in which out-migration causes (or permits) in-migration is probably not the general case. And, in general, communities do not purchase in-migrants to replace out-migrants, as businesses purchase machinery to replace equipment destroyed by fire. Thus, the loss of educational capital through out-migration represents an asset which is not replaceable in the sense of being repurchasable[4/], and so the most appropriate measure of educational capital lost through out-migration seems to be the present value of the persons' expected lifetime incremental productivity (earnings) stream. In any event there seems to be little logical justification for using historical production cost, as has been suggested elsewhere.[5/]

[4/] Though one can think of using subsidies to attract educated people, as subsidies are currently used to attract physical capital.

[5/] The point of view that the loss to a community due to out-migration should be measured at historical cost is taken by James G. Maddox who states, "in those communities in which...migration is limited mainly to maturing young people, the principal costs associated with it are those of rearing and educating children who move away...about the time they reach a productive age." "Private and Social Costs of the Movement of People out of Agriculture," American Economic Review, Proceedings, L (May, 1960), p. 397.

The analogy between human and physical capital serves to make clear that only the net revenue stream of the asset is relevant to its value. For physical capital the net revenue concept is clear, at least conceptually -- it is the excess of total revenue contributed by the machine over the costs associated with the machine during its lifetime; properly discounted, this excess is the value of the machine to its owner. But what is the net value to the community of the educational capital embodied in a person?

One answer, discussed above, is simply the present value of the incremental income stream resulting from education. But is it not a bit strange to say that out-migration results in the loss of this entire income to the community? After all, except in the sense of a geographic area in which certain people reside, the "community" would not receive the income even had the person remained. Income comes to people, not political abstractions; the fact is that education pays returns to the person that has it, and even if he moves he still obtains returns to his education. The financial stake which other community residents have in his education may be something other -- and undoubtedly less -- than all of his additional income. While the rest of the community could not expect to get all of the additional income resulting from its investment in education, it could expect to get a portion of it, through taxation.[6]

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[6] Throughout this discussion it is assumed that earnings are an adequate measure of the value of the marginal product of labor. Clearly, if labor receives less (more) than its marginal product, then the out-migration of a worker results in the loss (gain) of this surplus (deficit) to his employer who may reside in the community.

Thus, we turn now to the tax effects as a source of community benefit from education.

2. Tax Effects. Even if the incomes of the educated people rise but have no effects on the incomes of others, other members of the community may still expect to benefit from the education to the extent that the educated people pay higher taxes. If it is assumed that consumption of public services is not a positive function of one's level of income and education, but that tax payments are, then it is clear that by raising the incomes of some people the tax burden upon others may be reduced. Of course, it may be true that better educated, higher income people actually consume less public services, or possibly more. Insofar as police efforts are devoted toward thieves, juvenile delinquents, and the like, eventual reductions in these costs might be expected if education and income levels of the lowest groups could be raised. On the other hand, better educated people may consume more of such services as the public library.

3. Redistribution Effects. Community support for education (or at least certain types) might be viewed as partly reflecting a desire to increase the supply of certain types of labor in order to bring down their prices. This would explain, for example, the "public" concern over alleged heavy out-migration of physicians from the United Kingdom.

Support by some members of the community for the education of others might also represent a desire to avoid making even larger transfer payments (welfare aid, unemployment compensation) which later may accompany the low incomes of uneducated people. Of course, the transfers would involve private costs to the more affluent members of the communities in which the uneducated persons lived as adults, so that migration will determine which specific communities are involved. Without a specification of the social, or community welfare, function we cannot say whether a given income redistribution is beneficial or not. At the same time it is important to be aware of the distributional implications of educational activities.

4. Indirect Income Effects. If the productivity and income of some persons in the community were raised (e.g., by education) there might be secondary effects on the level of income and employment of others in that community. Thus, education of some people might be seen as redounding to the financial advantage of others in the community. These income-induced effects would tend to be lost (to another community) however, as a result of out-migration.

For purposes of this analysis we shall disregard employment aspects of education although, of course, this does not mean that people in the real world disregard these effects when considering the desirability of investing in public education. In fact, the belief that education will not only raise the incomes of certain people directly but will also raise the incomes of others indirectly may be a significant explanation for the local public support of education, and for the concern over out-migration of publicly educated people.

With full employment in the economy, or, more generally, with a given employment level, income-induced expansion in community A is offset, however, by contraction in B. This may be viewed as another form of income redistributive effect of education when it is accompanied by migration. While indirect income and employment effects of education will not be investigated in this study, it might be suggested that the size of these effects will tend to be positively correlated with the direct income effects.

So far this chapter has introduced concepts of several forms of financial effects of education; the remainder of it deals with the direct income effects of public elementary and secondary education on the community providing the education, and on other communities. The geographic dispersion of these effects is treated in Chapter 5. Chapter 6 discusses tax effects and Chapter 7 considers certain redistributive effects. All of these chapters attempt some monetary estimates of the magnitudes involved.

II

It is possible to associate virtually every desirable aspect of life with education. But, to show education as the cause is more difficult. For example, the correlation of income with the level of education attainment is well known.[7] Is education the cause, the effect, both, or neither? If one could study individuals identical in all relevant respects except education, and then show that those individuals with higher educational attainments received greater earnings, one might be safe in postulating a cause and effect relationship running from education to earnings.

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[7] See footnote 1.

When incomes are compared for persons of similar age, sex, race, and major U.S. region, but with different levels of education, it is found that persons with more education typically have greater incomes than persons with less education. Precisely what proportion of the observed income differentials is attributable to non-education factors associated with the level of education is most difficult to determine.[8/] However, there is scarcely any doubt that education does make a person more productive, and does thereby increase his earning power, even if the increase in earning power may not be quite so large as the income differentials actually observed.

In an effort to prevent overvaluation of the effects of education upon income, the estimates of benefits of education obtained below from Census data will be reduced by 40 percent (multiplied by 0.6) to adjust for the fact that the data do not hold all relevant factors other than education constant. In using the arbitrary 0.6 factor, we follow the lead of Edward F. Denison.[9/] Hopefully, we shall learn someday how large the adjustment factor really should be.

If education does increase productivity, public support for

[8/] See the discussion of this point in Chapter 3, above.

[9/] Edward F. Denison, The Sources of Economic Growth in the United States and the Alternatives Before Us. (New York: Committee for Economic Development, 1962), p. 69.

elementary and high school education may be viewed as public investment in the productivity of the local population. One portion of the return to the public from its investment might be the additional earning power (productivity) which the education generates. It follows from this reasoning that if a person in whom education resources were invested subsequently migrated to another community, the return to the community which undertook the public investment would be diminished, while another community, which played no role in the financing of the education of the individual, would now reap some of the returns from it. In short, the process of migration is a process of intercommunity spill-over or tranfer of human capital in the form of education.

We shall now proceed to present a method for estimating the magnitudes of human capital produced through public elementary and secondary education in a community. Then we shall show how future out-migration can be accounted for, in order to determine the proportion of educational capital expected to be realized within the original community and the proportion expected to be exported. Similarly, we shall consider in-migration and the associated community "imports" of educational capital. Having described measures of the production of educational capital and of its spill-ins (imports) and spill-outs (exports), we shall apply the measures to the case of Clayton, Missouri, 1959-60. Its expected spill-ins, spill-outs, and net spill-overs will be estimated.

The educational capital created in people through education may be defined conceptually as the present value of the expected additional marginal net productivity stream resulting from that education. Operationally, measuring marginal productivity by income reported in the Census, the unadjusted value of educational capital (E.C.) of a person of given age and level of education may be defined as:

$$\text{E.C.}_{a}^{j} = \sum_{n=a}^{75} \left[(Y_n^j W_n^j - Y_n^0 W_n^0 \; P_n \Big/ (1+D)^{n-a} \right] \qquad (1)$$

where subscripts indicate age in years, and superscripts _j_ and _0_ indicate the level (number of years) of education (running from 0 to 12); Y = median income of persons with income, so that Y_n^j is the income at age _n_ of a person with education _j_; W = the proportion of persons who have income; P = the probability of surviving at least one year more; and D = the rate of discount. The summation up to age 75 reflects the assumption that there is no additional income from education beyond age 75. To make the 0.6 adjustment discussed earlier, it is only necessary to multiply the E.C. values by that constant.

Using Census Bureau data, we have computed the present values of expected future income of people classified according to age, sex, and level of education, for whites in the South and the non-South of the country. In this way, by relating incomes to education attainments, we were able to estimate the _addition_ to a person's present value of lifetime income accompanying an elementary and high school education, or various portions thereof. Some of the results, in _unadjusted_ form, appear in column 3 of Table 4-2, later in this chapter. Others are in Appendix B. Limitations of these estimates are discussed in section IV of this chapter. Comparing the results for the South and the rest of the nation, it is interesting to note that the capital created through both elementary and secondary education in the South averages more than in the non-South, even though, as is well known, incomes are generally lower in the South; the key explanation is that inter-area income differentials narrow with increased education.

Next we ask how much of the capital created at each education level is lost to the area through out-migration. To answer this we need to know the proportions of the people educated in a particular area who leave it at each age. These out-migration "probabilities" can be introduced into equation (1) as a factor, M_n, multiplicative with P_n, where M_n is the probability of not out-migrating; the product M_nP_n thus becomes the probability that a person of age n will neither die nor out-migrate in the following year. The resulting present values indicate the additional income accompanying education which is expected to be realized "locally" -- that is, within the community providing the schooling.[10]

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[10] John K. Folger has raised the point that M_n, the migration probability, is a function of education as well as of age, so that education itself will increase the probability of migrating. This means that the use of average probabilities based on the population of a given age understates the monetary spill-outs which may be expected to result from raising educational attainments.

Census data support this thesis. The educational levels of migrants appear to be significantly higher than those of the entire population of the same age bracket. (See "source" of table below.) The "probability" of migrating at any given age and level of education is shown below; each "probability" is a ratio of the number of migrants of the stated age and education level to the total population of the same age and education level. Except for the lowest education group, migration rates rise with level of education in every age class. The incremental migration rates with respect to college education are considerably greater than they are with respect to high school education. (Continued on next page.)

12/ (Continued from preceding page)

Probability of Migrating at Given Ages and Levels of Education, United States, 1950

Education	**Age**					
	25 & Older	25-29	30-34	35-44	45-64	65 & Older
Less than 5 years	0.036	0.088	0.072	0.054	0.027	0.026
5-8 years	0.038	0.084	0.060	0.043	0.027	0.028
12 years	0.053	0.085	0.063	0.048	0.031	0.034
16 years	0.083	0.165	0.109	0.070	0.040	0.042

Source: Computed from data in U.S. Bureau of the Census, U.S. Census of Population: 1950, Vol. IV, Special Reports, Part 4, Chapter D, Population Mobility -- Characteristics of Migrants (Washington: U.S. Government Printing Office, 1957), Table 2, pp. 12-13.

If a community seeks to estimate the value to *it* of raising its educational level, it should recognize that by doing so, it will probably bring about increased migration. As a result, estimates of exports of educational capital which are based on current levels of education and current migration rates will tend to understate expected losses.

If it is reasonable to consider education, at least in part, as investment in human productive capacity the (monetary plus non-monetary) returns from which are desired by the community financing the education, then it follows that out-migration constitutes the loss of a productive asset from that community's point of view. Of course, in-migration may also be occurring, so that educational capital transfers have some tendency to cancel out even for a particular community. They will not generally cancel out entirely, of course, in communities experiencing net in- or out-migration; nor even in communities with no net migration, insofar as the ages and educational attainments of the in-migrants and the out-migrants differ.

The "cancelling out" concept must be understood to have two distinct aspects: distributional and allocative. If a given community receives as much educational capital through in-migration as it loses through out-migration we may say that with respect to these benefits of education, migration has been distributionally neutral in its effects.

But distributional neutrality does not imply allocative neutrality. It is one thing to talk about whether the spill-overs to and from a community are equal; it is another matter to consider whether the spill-overs affect the level and composition of economic (in this case, educational) activity. For example, if each of two communities, persons or firms, is causing external diseconomies (or economies) for the other in equal magnitude, the distributional effect will be zero -- the parties are hurt (benefitted) equally -- but an adverse allocative effect may be expected, with both parties producing super-optimal (sub-optimal) quantities of the commodities or services involved. If the diseconomies went only in one direction, the allocative effects would tend to be less severe though the distributional effects would no longer be neutral. In a later chapter (9) we shall return to this issue and attempt, among other things, a statistical test of the hypothesis that adverse allocative effects do result from spill-overs of educational capital through migration.

III

This section reports estimates of (1) educational capital produced by the public school system of Clayton, Missouri, (2) the portion of that capital which may be expected to remain in Clayton, and (3) the amount of educational capital produced elsewhere which may be expected to move into Clayton. The approach is to consider the entire twelve year public schooling process to be the period of educational capital formation, the private product of which is the resulting incremental lifetime productivity (in addition to any non-market, "consumption," benefits of education).

The educational capital estimates to be presented utilize Census Bureau findings on incomes of persons of given age, race, sex, and major region (South, non-South), but with different educational attainments. For reasons already discussed, the observed differentials will be multiplied by a factor of 0.6 to provide "adjusted" incomes which account in a rough-and-ready way for non-education factors influencing the Census findings. The adjusted incomes for the non-South will be assumed to apply to Clayton; that is, in the absence of specific data on the contribution of education to income among Claytonians, it was assumed that the contribution is the same as that observed by the Census for the non-South. This does not imply that a Claytonian with a given level of schooling will have the same level of income as the average non-Southerner of the same age, race, and sex, but only that the income differentials by level of education will be the same. After the findings for Clayton are presented, the limitations of the data and methodology will be discussed elsewhere.

The present value approach to estimating the production and geographic spill-overs of educational capital requires that an explicit discount rate be chosen. There have been a number of discussions of marginal private and social rates of time preference, of marginal *efficiencies of private investment, and other plausible bases for* selecting a rate;[11] but a "correct" empirical discount rate simply is not known, if indeed, it exists. Thus, the discussion which follows will cite findings obtained by using alternatively, a five and a ten percent discount rate; results at the latter will appear in parentheses. These two rates approximate the limits of the range of rates that have been used or suggested in other studies of return from public investments.

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[11] For view on "optimal" rates for discounting future benefits, see John V. Krutilla and Otto Eckstein, Multiple Purpose River Development: Studies in Applied Economic Analysis (Baltimore: Johns Hopkins Press, 1958), Chap. IV; Roland McKean, Efficiency in Government Through Systems Analysis (New York: John Wiley and Sons, 1958), pp. 116-22; and Stephen A. Marglin, "The Social Rate of Discount and the Optimal Rate of Investment," Quarterly Journal of Economics, LXXVII (February, 1963), pp. 95-111.

When a Clayton male[12] graduates from high school at the end of his seventeenth year, he represents an adjusted value of $14,500 ($7,000) of educational capital at a five (ten) percent discount rate, as is shown in Table 4-1.[13] Table 4-2, column 3, shows the *un*adjusted present values of primary plus high school, at each of the ages 6-17, assuming the student will complete high school, but disregarding the monetary value of the option to obtain additional schooling. For example, the value for a male at age 17, at a 5 percent discount rate, is shown as $24,100 in the top panel; $24,100 times 0.6 equals the $14,500 *adjusted* value previously cited.

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[12] The first part of this discussion deals solely with males. Females are discussed later in this section.

[13] The educational capital (E.C.) data were calculated as follows. Income data by age, sex, race (non-white and total), level of education, and major U.S. region were obtained from the Census data. (U.S. Bureau of the Census, *U.S. Census of Population: 1950*, Vol. IV, *Special Reports*, Part 5, Chapter B, Education (Washington: U.S. Government Printing Office, 1953), Table 13. These data, for white males, non-South, were for persons with income. We then multiplied them by the percentage of the population (in each cohort) with income (*Ibid*., Table 12) to obtain the "average income" ($Y^j_n W^j_n$ in equation 1) and subtracted from this the average income of persons of the same age, sex, race, and region with zero education ($Y^0_n W^0_n$). Survival data for St. Louis County, Missouri, and the appropriate discount rates completed the needed input data.

Introducing the gross out-migration factor into the equation yielded the present value of additional expected lifetime income which is exported (E.C.Ex.) -- that is, not received locally. The portion which is received locally (E.C.-E.C.Ex.) may be denoted E.C.L. (local). Considering gross *in*-migration only, E.C.Im. (import) is the educational capital produced elsewhere but moving to Clayton, per 1960 Clayton public school student. Finally, net educational capital (E.C.N.), is the sum of the local and "imported" educational capital (E.C.-E.C.Ex.+E.C.Im.).

Table 4-1

Adjusted Gross Values, Exports, and Imports of Educational Capital Developed by Schooling Through High School, White Persons, by Sex, Age 17, at 5 and 10 Percent Discount Rates, Clayton, Missouri, 1960

	Males		Females	
	5%	10%	5%	10%
(1) Gross Educational Capital (E.C.) per Student	$14,500	$7,000	$3,600	$2,000
(2) Exports of Educational Capital (E.C.Ex.) per Locally Educated Student	12,600	5,700	2,600	1,300
(3) Imports of Educational Capital (E.C.Im.) per Locally Educated Student	10,300	5,400	2,900	1,600

Notes: "Educational Capital" values (row 1) are the present values of the income differentials between high school graduates and persons with no formal schooling (for persons in the non-South), these differences being weighted by the probability of survival and in the case of exports and imports (rows 2 and 3), also being weighted by the probabilities of moving out of or into Clayton at each age. Finally, the present values are adjusted (multiplied by a factor of 0.6) to account for non-educational factors associated with education.

Estimates of exports and imports are based on our estimates of Clayton migration probabilities during 1960 (See Appendix A for methodology). All estimates of additional income resulting from education apply to white persons in the non-South in 1950. (A similar study from the 1960 Census has not been completed yet.)

Sources: U.S. Bureau of the Census, 1950 Census Special Reports, Education, op. cit., Tables 12 and 13; and Appendix A of the present study.

Table 4-2

Production, Exports, and Imports of Educational Capital, by Sex
Whites Only, 5 and 10 Percent Discount Rates, Clayton, Missouri, 1960

Note: Figures in this Table have not been adjusted downward
by the 0.6 factor discussed in the text above.
(000 omitted)

Males-5 Percent

(1) Grade (and Age)	(2) Number of Students	(3) E.C.	(4) E.C.Ex.	(5) E.C.Im.	(6) E.C.Im. -E.C.Ex.	(7) Total E.C.	(8) Total E.C.Ex.	(9) Total E.C.Im.	(10) Total E.C.Im. -Total E.C.Ex.
		(Per Locally Educated Student)			(5-4)	(2X3)	(2X4)	(2X5)	(9-8)
1 (6)	104	$14.0	$13.6	$10.1	$-3.5	$1,459	$1,416	$1,048	$-368
2 (7)	85	14.7	14.2	11.5	-2.7	1,253	1,211	974	-236
3 (8)	84	15.5	14.9	12.9	-2.0	1,300	1,251	1,081	-169
4 (9)	95	16.3	15.6	13.9	-1.7	1,545	1,479	1,322	-156
5 (10)	96	17.1	16.3	14.8	-1.5	1,640	1,562	1,421	-140
6 (11)	81	17.5	17.0	15.6	-1.4	1,453	1,315	1,265	-110
7 (12)	81	18.9	17.7	16.4	-1.3	1,527	1,434	1,324	-109
8 (13)	104	19.8	18.4	17.0	-1.4	2,059	1,918	1,769	-148
9 (14)	92	20.8	19.2	17.5	-1.7	1,913	1,764	1,614	-150
10 (15)	64	21.8	19.9	17.8	-2.1	1,398	1,271	1,140	-131
11 (16)	81	23.0	20.5	17.7	-2.8	1,860	1,660	1,436	-223
12 (17)	64	24.1	21.0	17.2	-3.8	1,545	1,346	1,161	-244
Total						18,957	17,690	15,502	-2,188

Table 4-2 (Continued)

Males-10 Percent

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 (6)	104	$ 4.0	$ 3.9	$ 3.3	$ -0.6	$ 419	$ 401	$ 340	$ -61
2 (7)	85	4.4	4.1	3.9	-0.2	376	358	331	-27
3 (8)	84	4.9	4.6	4.6	-0.0	409	387	385	-3
4 (9)	95	5.4	5.1	5.2	0.1	509	479	492	14
5 (10)	96	5.9	5.5	5.8	0.3	566	528	553	25
6 (11)	81	6.5	6.0	6.4	0.4	526	466	515	30
7 (12)	81	7.2	6.5	7.0	0.4	579	529	564	35
8 (13)	104	7.9	7.1	7.6	0.5	818	738	787	49
9 (14)	92	8.9	7.7	8.2	0.5	796	708	750	42
10 (15)	64	9.5	8.3	8.6	0.4	609	531	552	22
11 (16)	81	10.5	8.9	8.9	0.1	849	719	724	4
12 (17)	64	11.6	9.4	9.0	0.4	740	604	575	-28
Total						7,196	6,467	6,568	101

Females-5 Percent

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 (6)	91	$ 3.5	$ 3.2	$ 3.0	$ -0.1	$ 320	$ 287	$ 276	$ -11
2 (7)	108	3.7	3.3	3.9	0.7	398	353	424	71
3 (8)	91	3.9	3.4	4.4	1.0	353	308	398	90
4 (9)	100	4.1	3.5	4.9	1.4	407	350	487	137
5 (10)	84	4.3	3.6	5.4	1.7	359	303	441	138
6 (11)	82	4.5	3.7	5.5	1.8	368	305	451	146
7 (12)	76	4.7	3.8	5.6	1.8	358	291	426	135
8 (13)	78	5.0	3.9	5.6	1.7	386	307	439	131
9 (14)	91	5.2	4.1	5.6	1.5	474	368	506	138
10 (15)	74	5.5	4.2	5.4	1.3	404	307	399	93
11 (16)	83	5.7	4.2	5.1	0.8	476	351	427	76
12 (17)	78	6.0	4.3	4.8	0.5	468	334	374	40
Total						4,772	3,865	5,048	1,183

Table 4-2 (Continued)

Females-10 Percent

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1 (6)	91	$ 1.2	$ 1.0	$ 1.3	$ 0.2	$ 109	$ 93	$ 115	$ 22
2 (7)	108	1.3	1.1	1.5	0.4	142	120	159	39
3 (8)	91	1.5	1.2	1.7	0.5	132	109	156	47
4 (9)	100	1.6	1.3	2.0	0.7	159	129	200	71
5 (10)	84	1.8	1.4	2.3	0.9	147	116	189	73
6 (11)	82	1.9	1.5	2.5	1.0	158	121	202	81
7 (12)	76	2.1	1.6	2.6	1.0	161	120	199	79
8 (13)	78	2.3	1.7	2.7	1.1	182	131	213	82
9 (14)	91	2.6	1.8	2.8	1.0	234	162	255	93
10 (15)	74	2.8	1.9	2.8	0.9	209	140	209	69
11 (16)	83	3.1	2.0	2.8	0.8	258	165	231	66
12 (17)	78	3.4	2.1	2.7	0.6	265	161	208	47
Total						2,154	1,565	2,335	770

Note: Columns and rows may not sum to totals due to rounding.

E.C., E.C.Ex., and E.C.Im. stand for "Educational Capital," "Educational Capital Export," and "Educational Capital Import," respectively; these terms are defined in the text.

Source: U.S. Bureau of the Census, 1950 Census Special Reports, Education, Tables 12 and 13; Appendix A of this study; survival data for St. Louis County, Missouri, 1960; St. Louis County Public School District, Ninth Annual Report, pp. 29-30. See footnote 13 above, for computational details.

Although the additional income accompanying education seems to be quite substantial, the factor of migration results in part of the educational capital created in one community being available elsewhere. In the case of Clayton, estimates of the relative frequency of out-migration as a function of the person's age and sex have been developed (in Appendix A, below); and these have been converted into probabilities of remaining at least one more year in Clayton at each age -- probabilities which are formally analogous to the survival probabilities which entered into the gross present value computations discussed earlier. The new present values of "local" educational capital (E.C.L.) were then estimated. The differences between the "gross" and "local" educational capital -- differences which indicate the gross spill-over loss or "export" of educational capital per locally-educated student -- appear in Table 4-2, column 4.

Migration to and from Clayton is substantial, as it is for many communities; approximately twenty percent of the United States population changes place of residence in a single year.[14/] When allowance is made for the probability of out-migrating at each age, we find that of the $14,500 ($7,000) of educational capital developed by twelve years of schooling in Clayton, on the average, only $1,900 ($1,300) is retained in Clayton. Thus, approximately 87 (82) percent of the educational capital created by

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[14/] For the year March 1959-March 1960, 19.4%; for the year March 1960-March 1961, 20.0%. U.S. Bureau of the Census, Statistical Abstract of the United States: 1962 (83rd edition) (Washington: U.S. Government Printing Office, 1962), Table 34, p. 38.

Clayton in the process of educating a child through the twelfth grade accrues to the advantage of other communities -- that is, is realized in other communities.

While the vast majority of the educational capital created in Clayton flows into other areas, it is also true that a reverse flow occurs. Noting the age and sex distribution of in-migrants (as estimated in Appendix A) and assuming that, like the local population, they are also high school graduates, we find that Clayton receives $10,300 ($5,400) of externally produced educational capital for each child it educates locally. (Table 4-1.) Thus, for each child it educates through high school, Clayton exports $12,600 ($5,700) through out-migration but imports $10,300 ($5,400) through in-migration, for a net loss of $2,300 ($300) per child. This constitutes a net migration loss of 16 (4) percent of the $14,500 ($7,000) of educational capital produced per child in Clayton.

For the purpose of making comparisons with the educational capital estimates, we have determined the actual average total current cost of having educated for twelve years a person who graduated in 1960; ignoring compound interest, it was $7,200.[15] The present value of a male's additional

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15/ In correspondence dated April 5, 1963, George M. Stuber, Assistant to the Superintendent of the Clayton School District, supplied the following data on average current expenditures per student in average daily attendance:

Year	$	Year	$	Year	$
1951-52	$468.02	1954-55	$615.44	1957-58	$837.77
1952-53	548.58	1955-56	638.09	1958-59	854.28
1953-54	550.17	1956-57	691.57	1959-60	832.90

(continued on following page)

lifetime earnings resulting from education and accruing in Clayton, $1,900 ($14,500 - $12,600 at a 5 percent discount rate), is then only 26 percent of this total expenditures; at the same time, the present value of his total additional lifetime earnings regardless of where received, $14,500, is double the total current cost of his education.

The estimates in Table 4-1 for females differ from those for males, primarily because of differentials in income and in-migration patterns. At a 5 percent discount rate, Clayton exports through out-migration $2,600 of the $3,600 of educational capital created by twelve years of education for a female. However, it regains all of this and more -- $2,900 -- through in-migration.

In the school year 1959-60, there were 2,067 students enrolled in the Clayton public schools.[16] Estimating the number of males and females on the basis of the total Clayton (white) population, ages 6 through 17,[17] we can estimate the present value of expected future exports and imports of educational capital per member of the current student body.

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[15] (Continued)
The data for 1948-49, 49-50, and 50-51 were not available. These were estimated by extrapolating backwards at the rate of change of-$40.52 per year, the average yearly change for the nine known years. Thus, the twelve year total becomes $7,197.76, or essentially $7,200. Opportunity costs in the form of foregone earnings of students were disregarded.

[16] St. Louis County School Superintendent, *Ninth Annual Report of the St. Louis County Public Schools* (Clayton, Missouri, 1960), pp. 29-30.

[17] U.S. Bureau of the Census, *U.S. Census of Population: 1960, General Population Characteristics -- Missouri*. Final Report PC(1)-27 B (Washington: U.S. Government Printing Office, 1961), Table 27-20, pp. 27-59.

This may be done by multiplying the number of students by the export and import values of educational capital (E.C.Ex. and E.C.Im., respectively) per locally educated child of each sex and age. Using the assumption that each school child will become a high school graduate at age 17, we have computed these values for ages 6 through 17; the results, analogous to those in Table 4-1 except that the latter are adjusted for non-educational influences, are presented in Table 4-2 in detail. They are then summarized and adjusted in Table 4-3. The "production" figures (E.C.) in Table 4-2, column 3, are applicable to students in the non-South in general, except that St. Louis County survival data were used. However, data in the other columns are specific to Clayton, for migration rates to and from that city have been used.

We see in Table 4-3 that at a discount rate of 5 percent, $12.9 million, or 91 percent, of the total educational capital of $14.2 million in the 1959-60 public school body in Clayton can be expected to be exported to other communities. (Some of the education costs will be borne by other communities if the students leave prior to completing high school.) At the same time that Clayton can expect to lose much of the educational capital embodied in the 2,067 students, it can expect to gain $12.3 million in E.C. of persons educated elsewhere. Thus, Clayton's net position with respect to its 1959-60 student population involved an estimated expected loss of $0.6 million, or 4 percent of the expected educational capital value of its own students. It may be noted that this loss is the net result of an 11 percent loss for males and a 25 percent gain (on a smaller base) for females (Table 4-3).

Table 4-3

Adjusted Total Production, Exports, and Imports of Educational Capital, by Sex, Whites Only, 5 and 10 Percent Discount Rates, Clayton, Missouri, 1960: Summary (000 omitted)

	Males	Females	Total	Males	Females	Total
Production	$11,374 100%	$2,863 100%	$14,237 100%	$4,318 100%	$1,293 100%	$5,610 100%
Exports	10,614 94%	2,319 81%	12,933 91%	3,880 90%	939 73%	4,819 85%
Imports	9,301 82%	3,029 106%	12,330 87%	3,941 91%	11,401 108%	5,342 96%
Net Balance	-1,312 -12%	710 25%	-602 -4%	61 1%	462 36%	523 9%

Source: Table 4-2.

The relatively large net import (spill-in) of female E.C., at either discount rate, alongside the export or relatively modest import of male educational capital (at the 5 and 10 percent rates, respectively) merits comment. Table A-1 of Appendix A shows that at every age between 6 and 20, with the exception of 8 and 9, in-migration rates are higher, or out-migration rates are lower for females than for males; and these are the ages which have the greatest effects on the present value estimates for students.

IV

In the empirical section on Clayton, data limitations have led us to make several assumptions which should be made explicit, in order to facilitate assessment of the significance of our findings and methodology.

To begin with, we have assumed that in- and out-migrants of given age, race, and sex are equally valuable in terms of educational capital. That is, we have assumed that they have the same expectations of additional lifetime income resulting from their education -- and that all are, or will become, high school graduates. There are really two issues here. One is that we do not know the educational attainments of migrants to and from Clayton. The second is that even if we did know this, we would still not be sure that in- and out-migrants with the same number of years of schooling, and of the same age, race, and sex, would represent equivalent educational capital -- for example, because of different quality of their schooling.

With respect to the former point (educational attainments), it seems that in a community, such as Clayton, which is maintaining a relatively stable socio-economic class composition, educational attainments of persons coming into the community and of those leaving it will be similar; since we know that drop-outs in Clayton prior to completion of high school are virtually nil,[18] we are making what seems to be a quite plausible assumption -- namely, that every Clayton migrant is, or will be, a high school graduate.

With respect to the question of whether in- and out-migrants of given age, race, sex, major region, and level of educational attainment have equal expectations of earnings (or, to be more precise, have benefited equally in a financial sense from education), we are compelled by data limitations to assume they are, while quickly admitting the questionability of this assumption. The only reasonable comprehensive data relating income to educational attainment are Census Bureau figures, which do not provide more detailed classifications. Use of these data to estimate the community (Clayton) imports of educational capital seems reasonable, but it appears to introduce an upward bias in the estimates of exports (losses from out-migration). Insofar as migration represents the pursuit of higher earnings (rather than non-monetary goals, such as climate) migrants will tend to earn more in the destination community than they would have earned had they remained in their home community. Thus, migration tends to bring a loss of educational capital to the origin community which is less than the gain to the destination community; it follows that if the gain is estimated by the Census data, then the loss (as seen by Clayton) is smaller than the Census data, rather than equal to them, as was assumed above.

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[18] In correspondence dated October 5, 1962, Francis V. Lloyd, Jr., Superintendent of the Clayton School District, reported a total of 6 dropouts in the 1959-60 school year, or 0.24 percent of the total enrollment. One of these was for health reasons.

On the other hand there is a factor causing an opposite, downward, bias in the estimates of Clayton exports of educational capital. Clayton education expenditures per child are greater than twice the national average. If this means that Clayton provides an unusually high quality of schooling, the Clayton out-migrants will tend to have earning prospects greater than the national average as measured by Census data. (This may also be true of the in-migrants, although we do not know the magnitudes of the educational investment in persons who have migrated to Clayton.)

Whereas we have discussed only the income benefits of twelve years of schooling, Appendix B presents our estimates of (unadjusted) educational capital values for elementary school alone, and for other levels of schooling, for both the South and the non-South, by age and sex, though only for white persons. These should be useful for anyone wishing to replicate the Clayton empirical study for another area with other characteristics of either the in-migrants or the out-migrants, or both.

Of course, we could have made other assumptions about the Clayton migrants than that the in- and out-migrants of the same age, race, and sex were otherwise the same; in other communities or regions the relevant characteristics of in- and out-migrants might be substantially different. Had we assumed that the in-migrants had more (less) education than the out-migrants, then the net spill-outs of educational capital would have been smaller (larger), or might have become net spill-ins.

Another implicit assumption made above is that the future monetary value of schooling may be estimated from 1950 (actually 1949) data. As we have used them, the data probably are biased insofar as changes in the relative supplies of, and demands for, persons at various education levels will either narrow or widen existing earnings differentials. The direction of the bias, if one exists, is not clear. At the same time, the Census data are incomes, and from the point of view of the social productivity of education, we would prefer earnings; incomes may exceed earnings because of the inclusion in the former of property income and transfer payments. This tends to impart an upward bias to our estimates of educational capital.

Finally, a point already discussed should be reiterated. All of the income differentials found to be associated with educational differentials cannot be attributed properly to the effects of schooling; persons attaining higher levels of education tend to be more intelligent and ambitious than their less-educated counterparts. Thus, part of the greater income received by better educated persons is the result of their greater ability and drive -- rather than of their schooling. How large that "part" is we do not know. But because we feel this is so important, rather than disregard it we have assumed, rather arbitrarily, that it is forty percent; thus, the income differentials obtained from the Census data have been reduced by forty percent (multiplied by sixty percent) in order to separate the effects on earnings of influential factors other than education. All references to "adjusted" values indicate multiplication of the Census data, or data derived from them, by the "0.6 factor."

This chapter has made three principal points: (1) education appears to increase productivity and thereby to be a major source of investment in people -- in educational capital; (2) with a mobile population, much of the educational capital produced in any community will spill out, or be exported, to other communities; and (3) there is no assurance that a community's exports and imports of educational capital will be equal.

Chapter 5

Geographic Dispersion of Spill-Overs of Educational Capital

Mobility of the United States population is such that the vast majority of financial returns from public elementary and secondary schooling are generally realized outside the school districts which provided the child's education. The frequency of movement to and from any particular geographic unit depends upon a number of variables, including the size of the unit -- the smaller it is, the greater will tend to be its population turnover rate; the location of the unit -- core cities and rural areas are experiencing net out-migration while suburbs are growing; and the educational and employment characteristics of residents of the unit -- persons with more education tend to be more mobile, and persons in middle-management positions with national organizations tend to move relatively frequently. But the fact that one-fifth of the nation's population moves each year[1] makes it clear that geographic mobility is rather substantial for the country as a whole, whatever it may be for a specific area or community.

In the case of the St. Louis, Missouri suburb of Clayton, we have estimated in Chapter 4 that some ninety percent of the financial returns from education through high school will be obtained elsewhere.

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[1] For the year March, 1959-March, 1960, 19.4%; for the year, March, 1960-March, 1961, 20.0%. U.S. Bureau of the Census, Statistical Abstract of the United States: 1962 (83rd edition) (Washington: U.S. Government Printing Office, 1962), Table 34, p. 38.

However, we have not yet said anything about the degree of geographic dispersion of these returns. To this we turn now.

To what extent does a community produce educational capital for "near-by" communities, for more distant areas of the same state, for adjacent states, for the rest of the nation and the world? To what extent does that same community receive educational capital produced in each of these other areas? It would be particularly interesting to note the degree to which inter-community spill-overs occur within existing governmental units at the sub-national level (counties, states) or within economic units (such as Standard Metropolitan Statistical Areas). For insofar as the externalities, or spill-overs, of educational capital tend to bring about distributional or allocative effects which are felt to be undesirable, there is some conceivable fiscal unit which could internalize the effects, and thereby correct the situation. Is our existing structure of state and local governments adequate to their tasks in the case of education? And to what extent are multi-state units, such as the federal government, required to deal adequately with the effects of spill-overs of educational capital?

The geographic dispersion of the fruits of local public investment in education vary with the locality. In order to make this study concrete, the origin and destination of migrants to and from Clayton have been studied. Such data for particular communities are difficult to obtain, especially for destinations, but some idea can be obtained from school records. Useful Census data on origins of migrants to a particular area are available in published form, but while data on destinations of migrants exist (they are, after all, the same "origin" data looked at from another viewpoint), they are not published, and costly special tabulations would be required to obtain them.[2]

Table 5-1 presents estimates of origins of Clayton in-migrants computed from three different sources of information, and one set of estimates of destinations of out-migrants. Looking at the data on origins (columns 1, 2 and 3), we find that between 16 and 29 percent of the in-migrants (and, we may presume, an equal percentage of the educational capital) came to Clayton from the City of St. Louis. At present, the City of St. Louis and the surrounding St. Louis County, which includes Clayton, are not in a common governmental unit, except for the State of Missouri which is rather far removed from St. Louis area political problems; the existence of benefit spill-overs from the City to the County may help to explain the growing political pressure to bring City and County together politically, through mergers of various forms, or through the establishment of special districts.[3] Needless to say, such pressure is not limited to the St. Louis metropolitan area, nor are the reasons limited to spill-overs of educational capital. Moving down Table 5-1 we find that 24 to 34 percent of the Clayton in-migrants come from parts of the nation outside Missouri -- that is, outside of the largest sub-national government which includes both the origin and destination areas.

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[2] Census enumerators in 1960 asked where people lived in 1955. Thus, to find the destination of out-migrants from city A in 1955 would require checking the 1960 responses of each of the millions of persons who lived elsewhere in 1955, to find out how many had moved from A to each destination.

[3] However, recent efforts to bind the City and County politically have specifically excluded education; one might guess that the reason is not lack of concern in the City about spill-overs, but rather, strong pressures for "grass-roots" control of education, together with unwillingness of high income areas to share their wealth.

Using Estimates A (columns 1 and 4) of Table 5-1, we may compare Clayton's migration pattern with that of the nation as a whole. In the year 1949-50, 66.6 percent of the national migrants made intra-county moves, while only 53.7 percent of the migrant Claytonians moved within St. Louis County (the arithmetic mean of 49.3 percent of the in-migrants and 58.1 percent of the out-migrants). Inter-county, intra-state migrants (St. Louis City, Rest of St. Louis, S.M.S.A., Rest of Missouri) comprised another 17.2 percent of Clayton's total compared with 17.9 percent of the U.S. total; while Clayton's 29.0 percent interstate (actually, interstate plus foreign) migrants ranked somewhat above the comparable national figure of 15.5 percent.[4/]

In analyzing the data in Table 5-1 it should be remembered that they refer only to the immediate origins and destinations of migrants; we cannot be sure that these areas either provided, or benefited substantially from, the education of the migrants, who may move, or have moved, a number of times. Ideally, we would like to know (1) which

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[4/] Clayton data: Table 5-1; U.S. data: U.S. Bureau of the Census, U.S. Census of Population: 1950, Vol. IV, Special Reports, Part 4, Chapter B, Population Mobility -- States and State Economic Areas (Washington: U.S. Government Printing Office, 1956), Table 1, p. 4B-13.

Table 5-1

Migration Origins and Destinations, Clayton, Missouri, 1960

	Percent In-migrating From Area Indicated			Percent Out-migrating to Area Indicated
	Estimate A (1)	Estimate B (2)	Estimate C (3)	Estimate A (4)
Rest of St. Louis County	49.3	27.7	33.9	58.1
St. Louis City	15.8	35.7*	28.8	6.9
Rest of St. Louis SMSA	2.3		34.0*	1.1
Rest of Missouri	4.8			3.4
Rest of U.S.	24.5	33.8		28.4
Foreign	3.1	2.9	3.3	2.1

*These data are not broken down by smaller geographic units.

Sources: Columns 1 and 4 -- Norma Lee Lucas, "Pupil Mobility Information Compiled in the Department of Special Education for the Board of Education Meeting, October 15, 1962" (Clayton, Missouri: Clayton, Public School District, October 15, 1962), mimeograph, n.p.

Column 2 -- U.S. Bureau of the Census, U.S. Census of Population: 1960, General Social and Economic Characteristics -- Missouri. Final Report P C (1) - 27C (Washington: U.S. Government Printing Office, 1962), Table 27-72, p. 27-222.

Column 3 -- David Pittman and Sarah Boggs, "Analysis of Population and School Enrollment Trends in the Clayton School District" (St. Louis: Social Science Institute, Washington University, May, 1962), ditto, Table 18a, p. 96.

regions provided the education to each in-migrant, and (2) which regions will receive the benefits from the previous education of each out-migrant. With respect to (2) we would need to know the expected location of each out-migrant during the remainder of his lifetime following the completion of his education. Not having such data, we shall use the data presented in Table 5-1.

The largest absolute differences between the geographic distributions of Clayton's in- and out-migrants involves the City of St. Louis and the rest of St. Louis County. Clayton appears to have a substantial export "surplus" in its migration "trade" with the surrounding St. Louis County, but an even greater trade "deficit" with the nearby City of St. Louis. Moreover, since Clayton has overall net out-migration, the absolute number of out-migrants exceeds the number of in-migrants, so that even the approximately equal percentages of in- and out-migrants from and to the "rest of the U.S." implies an export surplus for Clayton in this bilateral "trade."

Unlike international, or even domestic, trade in commodities and non-human factor inputs, there exists no clearinghouse or settlement arrangements to bring about multilateral balance from bilateral imbalances. Some areas, communities, or nations may be chronic exporters of capital in the form of people in whom scarce resources have been invested -- in particular, through the provision of locally-financed public education.

Now we turn to the problem of determining the magnitudes of Clayton's exports and imports of educational capital according to geographic area.

These are shown in Table 5-2, which utilizes the migration data in columns 1 and 4 of Table 5-1. Estimate set A, in column 1, was used because it was the only complete distribution of in-migrants available.

Comparing this distribution with the incomplete, though presumably more accurate, Census distribution (column 2), we see that the former overstates the proportion of in-migrants coming from nearby St. Louis County (of which Clayton is a part), and understates the proportion coming from the "Rest of U.S.;" it might be guessed that the same is true for the out-migration distribution, column 4, although in this case we have no Census data for comparison. It appears then, that the educational capital exports and imports are even more widely dispersed than the estimates in Table 5-2 suggest.

Table 5-2 shows expected net exports of $603,000 in educational capital from Clayton over the lifetimes of its 1959-60 public school population (at the 5 percent discount rate). However, this surplus of educational capital exports is the resultant of sizeable expected net exports to St. Louis County and the "Rest of the U.S.," and expected net imports from all other regions, the amounts ranging from $110,000 from foreign sources to $1.1 million from the City of St. Louis. Whether a discount rate of 5 or 10 percent is used, St. Louis County and the "Rest of the nation" (outside the metropolitan area and the State of Missouri) benefit considerably from Clayton's public education while Clayton draws its greatest benefit from education in the City of St. Louis. It seems

Table 5-2

Adjusted Total Educational Capital Exports and Imports, by Region of Origin and Destination, Clayton, Missouri, 1960 at 5 and 10 Percent Discount Rates

(000 omitted)

	5 percent				10 percent		
	Percent (1)	Males (2)	Females (3)	Total (4)	Males (5)	Females (6)	Total (7)
Exports							
Total	100.0	$10,614	$2,319	$12,933	$ 3,880	$ 939	$ 4,819
Rest of St. Louis County	58.1	6,167	1,347	7,514	2,254	546	2,800
St. Louis City	6.9	732	160	892	268	65	333
Rest of St. Louis S.M.S.A.	1.1	117	26	142	43	10	53
Rest of Missouri	3.4	361	79	440	132	32	164
Rest of U.S.	28.4	3,014	659	3,673	1,102	267	1,369
Foreign	2.1	223	49	272	82	20	101
Imports							
Total	100.0	9,301	3,029	12,330	3,941	1,401	5,342
Rest of St. Louis County	49.3	4,585	1,493	6,079	1,943	691	2,634
St. Louis City	15.8	1,470	479	1,948	623	221	844
Rest of St. Louis S.M.S.A.	2.3	214	70	284	91	32	123
Rest of Missouri	4.8	446	145	592	189	67	256
Rest of U.S.	24.5	2,229	742	3,021	966	343	1,309
Foreign	3.1	288	94	382	122	43	166
Balance							
Total		-1,313	710	-603	61	462	523
Rest of St. Louis County		-1,582	146	-1,435	-311	145	-166
St. Louis City		738	319	1,056	355	156	511
Rest of St. Louis S.M.S.A.		97	44	142	48	22	70
Rest of Missouri		85	66	152	57	35	92
Rest of U.S.		-735	83	-652	-136	76	-60
Foreign		65	45	110	40	23	65

Note: Columns may not sum to totals due to rounding.

Source: Tables 4-3, 5-1.

quite likely that this series of relationships will frequently hold for suburban areas which are growing slightly, if at all, and for those characterized by net out-migration especially among young people.

Chapter 6

External Fiscal Benefits: I

I

In Chapter 3 we indicated that education might bring external economies (benefits) to persons who were in a common fiscal unit with those who were educated. This point is explored further in the present chapter and the one which follows. More precisely, this chapter attempts to shed light on the following related questions: Does public education constitute an investment that produces returns to the investor -- to the community -- that is, apart from the return to the student and his family? If so, what forms do the returns take, and are the returns of sufficient magnitude to make education a financially profitable community investment?

In Chapter 4, the additional income produced through education (educational capital) was discussed. This income is a benefit which accrues to the individual receiving the education, at least initially. But some of this private benefit will be captured by the rest of society (the community) through taxation. This provides one form of financial interest by other people (non-parents) in the education of children, and it is the subject of this chapter.

If the level of one's consumption of public services is independent of one's education and income, then the additional taxes generally paid by persons with more education and income either decrease tax burdens upon other taxpayers or increase output of public services; in either case the real income of some people increases as a result of the education of others. The same conclusion holds even if consumption of public services is not independent of education and income, provided that the additional taxes paid exceed the marginal cost of the additional services consumed.

Before proceeding, the reader should note that the additional tax revenue is a portion of the incremental earnings (productivity) resulting from education; the two cannot properly be added, unless of course the incremental earnings *net of taxes* are used. Depending on the point of view, one may measure the "community" benefits of education *either* by the entire additional earnings or by the portion -- that is, the tax net of any additional costs -- that is obtained by persons other than those receiving the schooling. The procedure adopted in Chapter 10, where results of this study are summarized, is to present separately the tax benefits and the additional-income benefits net of taxes, and thereby to consider community benefits to be the sum of, or at least a function of, the two.

The following discussion will analyze the returns to the rest of the community in the form of additional tax revenue resulting from investment in the education of its youth. The point has been made above that migration has the effect of transferring educational capital from one area to another. Now we recognize that along with the movement of people goes the source of the additional taxes which the investing community might otherwise have reaped.

External benefits of this sort may accrue even without migration. This is true insofar as political jurisdictions other than the one that provided the education share in this revenue or the fruits of the revenue. Generally speaking, an individual pays taxes to a number of political jurisdictions: the community, the county, the state, and the nation. Again, to the extent that the additional taxes paid by people with more education exceed the marginal cost of any additional public services they consume because of their additional education and income, some of the benefits of education are thereby transferred to other people within the fiscal units. The entire nation benefits from additional taxes paid to the federal government, the entire state benefits directly from additional taxes paid to the state; and so on, for additional taxes paid to the county and community as a result of education. Thus, with existing fiscal arrangements, education in one community has financial implications for persons in other communities in a common political unit; some of the benefits of education are shared by "outsiders."

II

From our investigation in Chapter 4, we know that a white male, age 18, may expect an additional $14,500 in present value of adjusted lifetime income[1/] because of his 12 years of education; a white female may

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[1/] At a 5 percent discount rate.

expect an additional \$3,600.2/ How much of the private returns are recouped by the rest of society through taxation, and how widely dispersed are these social fruits of education?

To begin with we shall try to answer this question under the assumption that the locally-educated person does not migrate. The method will be to estimate the percentages of the educational capital produced by twelve years of schooling that are paid in taxes to various governmental units. Recent estimates of these percentages, by income class, are presented in Table 6-1. The estimates for the income classes, \$2,000-\$3,999 and less-than \$2,000, are repeated in columns 1 and 4, respectively, of Table 6-2. It was determined that average annual incomes of white males with no education in the non-South tended to be in the former income bracket, and white females tended to be in the latter income bracket; while incomes of high school graduates were, of course, higher; the typical incomes remained in the same brackets. Row 1 of Table 6-1 indicates that around 20 percent of gross income is taxed away by some level of government in the forms indicated.

Next, in Table 6-2 the capital values of a high school education at 5 and 10 percent discount rates, for males and females, were multiplied by the tax percentages in columns 1 and 4 to obtain the estimated present values of additional lifetime tax payments to the federal government, and

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2/ These present values fall to \$7,000 and \$2,000 respectively, if a 10 percent discount rate is used.

Table 6-1

Taxes as a Percent of Income, Excluding Social Security, 1958

	Income Bracket							
Tax Category	Less than $2,000	$2000-3999	$4000-5999	$6000-7999	$8000-9999	$10,000-14,999	$15,000 and over	Average
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Total*	21.4	20.2	20.5	21.2	19.6	19.4	24.5	21.1
2. Federal								
a. Income	2.3	5.3	7.0	9.0	8.4	9.7	15.9	9.6
b. Excises & Customs	5.1	3.9	3.6	3.5	3.3	2.9	1.7	3.1
c. Estate & Gifts	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.4
3. State and Local								
a. Income	0.6	0.9	0.7	0.3	0.2	0.3	0.7	0.5
b. Excise & Sales	6.0	4.6	4.3	4.1	3.9	3.5	2.1	3.6
c. Estate & Gifts	0.0	0.0	0.0	0.0	0.0	0.0	0.4	0.1
d. Property	7.4	5.5	4.9	4.3	3.8	3.0	2.1	3.8

*Totals are simply column sums. The "totals" indicated in the sources below also include estimated burdens of the corporate profits tax.

Source: R. A. Musgrave, "Estimating the Distribution of the Tax Burden," (Baltimore: The Johns Hopkins University, mimeographed, no date), Table A-4, p. 23; these estimates are modifications of the data in G. A. Bishop, "The Tax Burden by Income Class," National Tax Journal, XIV (March 1961), Table IV, p. 54.

Table 6-2

Adjusted Present Values at Age 18 of Additional Lifetime Tax Payments Resulting from 12 Years of Education per Student; Whites, North and West United States, 1950 Income Data, 1958 Tax Rates, at 5 and 10 Percent Discount Rates

Form of Tax	Males			Females		
	a/ Tax Rates (1)	Present Values of Additional Tax Payments from the Educational Capital of: c/ $14,500, at 5% (2)	c/ $7,000, at 10% (3)	b/ Tax Rates (4)	Present Values of Additional Tax Payments from the Educational Capital of: c/ $3,600, at 5% (5)	c/ $2,000, at 10% (6)
1. Total*	20.2%	$2940	$1400	21.4%	$770	$430
2. Federal						
a. Income	5.3	770	370	2.3	80	50
b. Excises & Customs	3.9	570	270	5.1	180	100
c. Estate & Gifts	0.0	0	0	0.0	0	0
3. State and Local						
a. Income	0.9	130	60	0.6	20	10
b. Excises & Sales	4.6	670	320	6.0	220	120
c. Estate & Gifts	0.0	0	0	0.0	0	0
d. Property	5.5	800	380	7.4	270	150

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a/ For the annual income bracket, $2000-3999.

b/ For the annual income bracket, less than $2000.

c/ From Table 4-1.

*Totals are simply column sums. The "totals" indicated in the source below also include estimated burdens of the corporate profits tax.

Source: Tables 4-1, 6-1.

to the state and local governments. This procedure assumes that the average tax rate for the income bracket is a reasonable measure of the marginal tax rate on additional income within the bracket. We see, then, that a white male with an estimated $14,300 in present value of adjusted additional income resulting from his high school education may be expected to pay additional federal taxes which have a present value, at the time schooling is completed, of around $1,300, and additional state and local taxes with a present value of some $1,400.[3]

All of the taxes except one listed in Table 6-2 are based on personal income or expenditures; with respect to these it is easy to see how the increased income resulting from education leads to increased tax payments. In this way other people share in the real benefits of education. The one exception, the one tax which is based on neither income nor expenditure, is the property tax. However, it seems reasonable to assume that increased income also tends to result in increased property tax payments either directly by virtue of accumulation of real property, or indirectly by virtue of rental housing payments which reflect property taxation.[4]

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[3] At the 5 percent discount rate.

[4] Anticipating the analysis later in this chapter of the effects of migration on the geographic distribution of tax payments, we might comment here on the relevance of real property taxes. Although persons with more education and income may tend to purchase more expensive dwellings or otherwise become contributors of additional property taxes, it might appear to the reader that *migration* would not affect a community's property tax receipts, for title to property would merely change hands without influencing aggregate revenue. However, in the long-run chronic net out- (or in-) migration will tend to depress (enhance) property values and, ultimately, assessed values and tax payments.

Considering the variety of taxes paid to federal, state, and local governments, we see from Table 6-2 (and Table 6-3, below) that the lion's share of the return from education which the public receives through taxation spills out to higher level fiscal units. Of course the higher level governments may provide additional services to the better-educated persons; in this case the apparent spill-over, or external benefit, is a payment for services rendered, at least in part.[3] It is primarily to the extent that the higher level governments are serving as agencies for income redistribution that the additional taxes accompanying additional education and income have external effects.

III

Let us now return to the case study community, Clayton, Missouri. Table 6-3 shows the estimated present values of additional lifetime taxes paid to various governmental levels by Claytonians as a result of their having obtained 12 years of schooling. It is important to emphasize that the tax spill-overs resulting from education and shown in Table 6-3 result entirely from the fiscal structure; later we shall consider the influence of migration on the magnitude and locus of spill-overs (Table 6-4, below).

The rates of taxation in Table 6-3 (columns 1 and 4) merit explanation. For the federal government, they are identical to those in

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[3] Even if the better-educated person consumes more public services, if he pays more in taxes than the marginal cost of his additional consumption other people will still benefit.

Table 6-2. For the state, county and local levels of government, most are disaggregated from the "state and local" category in Table 6-2. Thus, for example, the state and local property tax rate of 5.5 percent shown in Table 6-2 for the income bracket, $2,000-$3,999, was assumed to apply to Clayton residents, and was distributed among the city (Clayton), county (St. Louis), and state (Missouri) governments in the following manner: first the total property tax receipts of each governmental unit were multiplied by the ratio of Clayton's income to the income of all persons within that particular unit in 1960.[6] The resulting three figures were estimates of the contribution by Clayton residents to the total property tax revenue of each level of government. Second, the ratios of each of these three amounts to the total of the three were multiplied by the assumed total property tax rate of 5.5 percent to obtain the rates for each government level. Thus, having found that approximately 51 percent of the property taxes from Clayton were paid to the County, 45 percent to the City of Clayton, and 4 percent to the State of Missouri,[7] we have distributed the 5.5 percent of income in the same proportions among the governmental units.

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[6] Thus it was assumed that Clayton residents paid percentages of state and county property taxes equal to the percentages that Clayton income was of Missouri and St. Louis County income.

[7] Sources of property tax data were: Missouri data -- U.S. Bureau of the Census, Statistical Abstract of the United States, 1961 (Washington: U.S. Government Printing Office, 1961), Table 344, p. 416; St. Louis County data -- U.S. Bureau of the Census, County and City Data Book: 1962 (Washington: U.S. Government Printing Office, 1962), Table 2, p. 116; Clayton data -- private correspondence. Income data obtained from: U.S. Bureau of the Census, U.S. Census of Population: 1960, General Social and Economic Characteristics, Missouri, Final Report PC (1)-27C (Washington: U.S. Government Printing Office, 1962), Tables 65, 76, 86, pp. 27-204, 242, 309.

The excises and sales, and estate and gift tax rates were assigned solely to the state, since for the most part these taxes are not levied by lower-level governments, at least in Missouri. The income tax rate for Missouri was estimated at 1 percent, the lowest bracket rate, on the assumption that all of the additional income resulting from education through high school would be taxable and still within the 1 percent bracket. Finally the St. Louis City earnings tax was estimated at 0.5 percent. This tax is a flat 1 percent of the gross earnings of people working within the City of St. Louis, regardless of residence. Lacking real evidence, and relying on impressions, we estimated that half of the Clayton labor force worked within the City; hence the effective rate would be 0.5 percent of the total earnings of all Claytonians, assuming that average earnings of those who worked in St. Louis and of those who worked elsewhere were equal.

Table 6-4 introduces into the fiscal spill-over model of Table 6-3 the external effects of migration. From Chapter 4 we know that at the 5 percent discount rate, 94 percent of the additional lifetime income of a white, 18 year old male high school graduate is exported through migration. Insofar as taxes are based upon income, it may be assumed that 94 percent of the potential Clayton additional tax revenue -- i.e., the tax revenue resulting from 12 years of schooling -- is exported. Similarly, the other values in row 1a of Table 6-4 are the percentages of educational capital and of present values of additional tax revenue per locally-educated child which can be expected to be lost (exported) or gained (imported) by Clayton through migration. The figures in row 1b are the products of the percentages

Table 6-3
Adjusted Present Values of Additional Lifetime Tax Payments Resulting From 12 Years of Education Per Student; Whites, Clayton, Missouri, 1950 Income Data, 1958 Tax Rates, at 5 and 10 Percent Discount Rates

Form of Tax	Males Tax Rates a/ (1)	Males Present Values of Additional Tax Payments from the Educational Capital of: $14,500, at 5% c/ (2)	Males Present Values of Additional Tax Payments from the Educational Capital of: $7,000, at 10% c/ (3)	Females Tax Rates b/ (4)	Females Present Values of Additional Tax Payments from the Educational Capital of: $3,600, at 5% c/ (5)	Females Present Values of Additional Tax Payments from the Educational Capital of: $2,000, at 10% c/ (6)
1. Total*	20.8%	$3,030	$1,440	22.3%	$810	$460
2. Federal						
a. Income	3.3	770	370	2.3	80	50
b. Excises & Customs	5.9	570	270	5.1	180	100
c. Estate & Gifts	0.0	0	0	0.0	0	0
Subtotal	9.2	1,340	640	7.4	260	150
3. State						
a. Income	1.0	150	70	1.0	40	20
b. Excises & Sales	4.6	670	320	6.0	220	120
c. Estate & Gifts	0.0	0	0	0.0	0	0
d. Property	0.2	30	10	0.3	10	10
Subtotal	5.8	850	400	7.3	270	150
4. County						
a. Property	2.8	410	190	3.8	140	80
5. City of St. Louis						
a. Earnings	0.5	70	40	0.5	20	10
6. City of Clayton						
a. Property	2.5	360	170	3.3	120	70

a/ For the annual income bracket, $2,000-3,999. b/ For the annual income bracket, less than $2,000. c/ From Table 4-1.

*Totals are simply column sums. The "totals" indicated in the source below also include estimated burdens of the corporate profits tax.

Source: Present Value Data: Table 4-1. Tax Rate Data: Table 6-1 and text above. Also fn.7.

in row 1a and the dollar magnitudes beneath the column numbers. The latter data (taken from Table 6-3, line 6a) indicate the additional tax benefits which Clayton would obtain if there were no migration; the former percentages indicate the portions that Clayton tends to lose and gain through migration.

Following Table 5-1 we shall assume that Clayton's exports and imports are distributed geographically according to the destinations and origins of the migrants. Thus, since 58.1 percent of the Clayton out-migrants move into the rest of St. Louis County, 58.1 percent of the $340 present value of Clayton's expected loss of tax revenue is assumed to be exported to the rest of the County (at the 5 percent discount rate, for males). Similarly, since 49.3 percent of the Clayton in-migrants come from the rest of St. Louis County, that percentage of the $300 present value of the expected gain in tax revenue is assumed to be imported from the county (again, at 5 percent, for males).

In this chapter we have shown, first, that part of the financial return which a student obtains from his education is returned to the community through taxation. Second, we have shown that in a federated fiscal system, such as we have in the United States, a portion of the student's increased income will also be shared with persons outside his community. Third, we have shown that migration adds another dimension to the analysis of geographical external benefits of education. To summarize: our tax system and labor mobility contribute to making education more than a matter of student concern, and even more than a matter of local community concern.

Table 6-4

Adjusted Present Values at Age 18 of Spill-overs of Additional Lifetime Tax Payments Resulting from Twelve Years of Education Per Student, White Persons, Clayton, Missouri, 1950 Income Data, 1958 Tax Rates, at 5 and 10 Percent Discount Rates

Area of Spill-over	Exports				Imports				Net Spill-overs			
	Males		Females		Males		Females		Males		Females	
	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%	5%	10%
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	$360 (100%)	$170 (100%)	$120 (100%)	$70 (100%)	$360 (100%)	$170 (100%)	$110 (100%)	$70 (100%)				
1. Total Spill-overs												
a. Percent	94	90	81	73	82	91	106	108				
b. Value	340	150	100	50	300	150	110	80	-40	*	20	30
2. Rest of St. Louis County a/ (49.3%; 58.1%)	200	90	60	30	150	80	40	40	-50	-10	*	10
3. St. Louis City (15.8%; 6.9%)a/	20	10	10	*	50	20	20	10	30	10	10	10
4. Rest of Missouri (7.1%; 4.5%) a/	20	10	*	*	20	10	10	10	*	*	10	10
5. Rest of U.S. (24.5%; 28.4%) a/	100	40	30	10	70	40	30	20	-30	*	*	10
6. Foreign (3.1%; 2.1%) a/	10	*	*	*	10	*	*	*	*	*	*	*

*Less than $5.

a/ Percent of total spill-ins (imports), and percent of total spill-outs (exports).

Columns may not sum to totals due to rounding.

Source: Tables 4-3, 5-1, 6-3.

Chapter 7

External Fiscal Benefits: II

In Chapter 6 we considered the additional taxes paid out of education-generated income as one form of benefit which education of some people bestows on others in the same fiscal unit; the community as a whole obtains part of the added productivity resulting from its investment in education. Now we investigate some other forms of external benefits to persons in the same fiscal unit. In particular, we analyze the reduced public sector aid and resource-cost requirements associated with effective education. In this way we consider further the nature of the fiscal interdependence between education decisions in community A and economic burdens in B. As before, we distinguish real from pecuniary effects.

The real benefits of education are the real costs of non-education. Thus, we need to recognize any real costs incurred by community B as a result of a failure by A to provide adequate education. More or better education by A would be likely to reduce police, judicial, and other costs of crime, delinquency, and law enforcement to the extent that the latter are related to insufficient or poor quality education. Inadequate education is associated with high unemployment (Table 7-1) and low income (Chapter 4), and these are likely to encourage crime. It would be erroneous to attribute to inadequate education all of the differential unemployment and income of the poorly educated. It would be equally erroneous to attribute all crime to low income. Nevertheless, insofar as low income brings added crime, certain real social costs result from lack of education.

This seems to provide one financial incentive to supply public education of quantity and quality which will make the future labor force members suitable for employment -- apart from the many other arguments for quality education. But the incentive seems to exist in part because of an implicit assumption that the burden of the cost of crime -- in part a cost of inadequate education -- will fall upon the very communities which previously failed to provide the necessary education. The trouble is that the assumption is simply invalid; the mobility of the United States population is such that any community, and, to a smaller degree any state, can expect a large proportion of its current youngsters eventually to move. In that case the costs of inadequate education will be borne externally, and the incentive to provide education of high quality and to prevent drop-outs is reduced. As in a competitive market model, one small part of the society may not recognize, or if it does, it may not be concerned with, costs or benefits of its actions to outsiders. However, society as a whole must realize that there are real benefits to residents of B resulting from education in A. Communities experiencing substantial in-migration of poorly educated persons ill-suited for industrial or commercial employment are increasingly aware of the desirability of more and better education in the origin areas.[1]

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[1] For example, a current study in Chicago has disclosed that 33 percent of the unemployed, able-bodied, men studied had received their education outside the State of Illinois; they averaged less than nine years of schooling, though on a standardized reading performance test well over 50 percent failed to read at the "completed fifth grade level." (Correspondence with Deton J. Brooks, Jr., Director of Research and

(continued on following page)

Levels of educational attainments as measured by years of schooling vary considerably from state to state, and if quality were also to be measured, the variations would probably turn out to be even greater. Table 7-2 presents some evidence of interstate differences in educational accomplishments. These differences suggest that the process of population migration will inevitably mean that some persons with little education will be moving to other states in which, being handicapped by their lack of schooling, they may constitute a social problem.

Reductions in crime and law enforcement costs are not the only forms of external real benefits from education. A community may decide that rather than incur the implicit and explicit costs of crime the best means for dealing with the social problems accompanying inadequate childhood education is to provide adult education. Thus, the failure of community A to educate its children suitably may result in additional education cost burdens on B. These external costs of lack of education (benefits of education) are, of course, alternatives to the crime and law enforcement costs discussed above. If complete data were available and one wished to estimate the full external benefits of education one would want to consider both forms, recognizing that the law enforcement costs might have been larger but for the adult education activities.

1/ (Continued)
Statistics, Cook County Department of Public Aid, May 24, 1963.) The point is not whether other states do a better or worse educational job than Illinois does, but only that education in one state affects other states.

Table 7-1

Unemployment Rates by Educational Attainment and Sex
March 1959

		Percentage Unemployed	
Years of School Completed	**Both Sexes**	**Male**	**Female**
Total	**6.2**	**6.3**	**6.0**
No school year completed	**11.9**	**12.6**	**9.7**
Elementary: 1-4 years	**9.5**	**9.3**	**10.4**
5-7 years	**9.8**	**9.7**	**9.8**
8 years	**7.0**	**7.3**	**6.5**
High School: 1-3 years	**8.5**	**8.1**	**9.3**
4 years	**4.8**	**4.9**	**4.7**
College: 1-3 years	**3.5**	**3.3**	**3.8**
4 years	**1.8**	**1.9**	**1.5**
5 or more years	**0.7**	**0.7**	**0.6**
Median school years completed	**(9.9)**	**(9.5)**	**(10.7)**

Source: U.S. Department of Labor, Bureau of Labor Statistics, *Special Labor Force Reports, No. 1*, p. A-7. This "Report," undated, contained a statistical appendix, from which the data presented above were extracted, and a reprint from the February 1960 *Monthly Labor Review* of "Educational Attainment of Workers, 1959," by Arnold Katz.

Table 7-2

Educational Attainments of the Population 25 to 29 Years Old, Ten High and Low States, 1960

State	Percent of Population 25-29 Years Old (1960) High School Graduates or Greater	Median Level of Education of the Population 25-29 Years Old (1960)	
		Males	Females
	(1)	(2)	(3)
Nebraska	73.2	12.5	12.5
Utah	73.2	12.8	12.5
Minnesota	72.3	12.5	12.5
Iowa	72.1	12.5	12.4
Hawaii	71.6	12.5	12.4
Kansas	71.1	12.5	12.4
Washington	70.5	12.6	12.4
Colorado	69.4	12.6	12.5
Wisconsin	69.3	12.4	12.4
Wyoming	69.2	12.5	12.4
West Virginia	51.1	12.0	12.0
Louisiana	49.8	12.0	11.9
Alabama	48.5	11.9	11.7
North Carolina	48.3	11.2	12.0
Arkansas	48.3	11.9	11.7
Tennessee	47.7	11.4	11.8
Georgia	47.6	11.7	11.7
Kentucky	44.2	10.7	11.2
Mississippi	44.2	11.3	11.2
South Carolina	43.2	10.7	11.3

Sources: Column (1): John K. Folger and Charles B. Nam, "Educational Trends from Census Data," paper presented to the Population Association of America, Philadelphia, April 26, 1963, Table 6, n. p.

Column (2), (3): U.S. Bureau of the Census, U.S. Census of Population: 1960. Detailed Characteristics, various states, Final Report PC (1)-2D through 52D, (Washington: U.S. Government Printing Office, 1962), Table 103.

The fact that inadequate attention to education in one locality may subsequently necessitate the incurrence of real costs elsewhere became quite clear during World War II. At that time we learned that the problem of illiteracy was not a matter of strictly local concern: illiterate adult males were unable to serve in the Armed Forces at a time of critical need. The inadequate education of these men when they were youngsters thus led to the establishment of educational programs for them as adults in the Armed Forces. Of course, the latter programs were financed out of federal funds whereas the schooling of youngsters would have been financed out of local and state funds. In this manner the primary burden of supporting the education of this group was transferred from local to federal sources.

In 1943 the Army Special Training Unit was established to provide remedial training in reading, language, and arithmetic.[2] About sixty percent of the classroom time, or about eighteen hours per week, was spent on basic literacy training for a maximum of twelve weeks.[3] Between this program and a similar one run by the Navy, more than 400,000 men spent an average of perhaps ten weeks in these schools.[4] The resource costs of

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2/ Major Paul A. Witty and Captain Samuel Goldberg, "The Army's Training Program for Illiterate, Non-English Speaking, and Educationally Retarded Men," Elementary English Review, XX (December, 1943), pp. 306-07.

3/ Ibid., pp. 306-07; see also American Council on Education, The Armed Forces and Adult Education (Washington, D.C.: 1947), pp. 182-83.

4/ Eli Ginsberg and Douglas W. Bray, The Uneducated (New York: Columbia University Press, 1953), pp. 72, 188.

the schooling, including teachers' time and classroom space, and the opportunity costs of the "students" time (the money value of a combat soldier's time) are, to say the least, difficult to estimate.[1/] There would seem to be little question, though, that the costs were at least as great as the $73 per month salary paid to the participating privates. Even at this modest cost estimate, the total cost of the program for 400,000 men for sixty percent of the time during two-and-a-half months would have been $43 million. Outsiders would have benefited by at least this amount if communities had provided adequate schooling in the first instance.

The fact that the origins of the illiterates were very unequally distributed among the states means that the geographic dispersion of the real cost of the adult education was different and broader than the dispersion of the costs of educating them as children would have been. Some evidence exists that the origin of the illiterates was disproportionately from the southeast part of the country, if we may judge by the data on military rejections for "mental" reasons in 1940, prior to the initiation of the programs to educate the illiterates; as shown in Table 7-3, the rejection rate was 97 per 1000 registrants in the southeast, which was almost two-and-one-half times the average rate for the U.S. (and the U.S. rate was pulled up by the rate for the southeast). Of the total number

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[1/] In a letter from the Adjutant General's Office dated 9 October 1962, Major General J. C. Lambert stated that, "It is impossible to furnish you with cost figures (for the education of illiterates) as such, since they are not known and would have to be estimated or broken out of many accounts."

of rejectees during the year, sixty percent were from the southeast.[6]

Regardless of whether the cause of the low educational attainment was lack of ability or lack of desire to finance schooling, adverse social conditions or cultural values, once again the fact remains that the results were felt by persons in other political jurisdictions. Real benefits in the form of reduced social costs may accrue to outsiders from local decisions to provide effective education.

II

So far we have discussed the resource cost benefits (burdens) which adequate (inadequate) education may bring to outsiders -- persons who were not parties to the earlier educational decisions. Now we turn to the pecuniary benefits (transfer payments) involving private benefits (costs) to outsiders as a result of adequate (inadequate) education elsewhere. In doing so we must bear in mind that from an overall social point of view income transfers and real benefits of education normally will not be additive; for every transfer benefit there is a transfer cost of equal dollar magnitude.

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[6] 1940 Census data show relatively low educational attainments for these states. In the eleven southeastern states (Virginia, North and South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas and Louisiana), 6.1 percent of the male population 25 years of age and over had received no formal schooling; the corresponding figure for the rest of the nation was 3.2. Similarly, 20.2 percent of the southeastern states' adult male population had only 1-4 years of schooling, compared with 7.4 percent for the rest of the nation. (Calculated from U.S. Bureau of the Census, Sixteenth Census of the United States: 1940 Population, Vol. I, Number of Inhabitants, Table 3, p. 14; Vol. II, Characteristics of the Population, Part 1, United States Summary and Alabama-District of Columbia, Table 26, pp. 60-78 and Table 31, p. 83.

Table 7-3

Selective Service Registrants Rejected for Mental Reasons in World War II, by Race and Region of Residence, 1940

Area	Total Rejections		White Rejections[a]		Non-White Rejections	
	Number (1)	Rejections per 1000 Registrants (2)	Number (3)	Rejections per 1000 Registrants (4)	Number (5)	Rejections per 1000 Registrants (6)
New England	20,765	17	19,803	16	962	65
Middle Atlantic	71,416	13	49,708	11	21,708	67
South East	435,639	97	167,599	32	268,040	202
Central	70,460	14	57,274	12	13,186	61
North West	13,089	14	12,530	13	559	40
South West	89,881	66	70,661	54	19,220	107
Far West	13,150	10	11,725	9	1,425	50
Total, U.S.	716,400	40	391,300	25	325,100	152

[a] Includes American Indians and Latin Americans.

Source: Ginzberg and Bray, *The Uneducated*: Cols. 1, 3, and 5, pp. 30-31; Cols. 2, 4, 6, pp. 32-33.

This is not so for a real benefit.

It is common in economic analyses to study real, resource-allocation aspects of a problem while avoiding distributional issues on the ground that they are normative matters which can be dealt with seperately in the real world through appropriate taxes and subsidies. It is true that in principle there exists a system of taxes and subsidies that can bring about any desired income distribution, thereby counteracting any unwanted distributional effects of measures undertaken on allocative-efficiency grounds. Yet in spite of the theoretical possibility of such a system, the practical difficulties of developing it are generally insurmountable. As a result, society fails to achieve fully its distributional goals. The upshot of this is that to make intelligent decisions on expenditure policy society needs to be informed not only on the allocative efficiency of its expenditures (that is, on whether potential benefits exceed costs), but also on the distributive effects. This is the justification for our concern in the present chapter with some distributional effects of public education.

We have already referred to the well-known relationship between level of education, unemployment, and income. Persons with little education are typically among the lowest group in earnings from employment. In an attempt to ameliorate conditions, the more fortunate members of society may feel constrained to provide aid to the lowest income recipients. The resulting transfer payments may take a variety of forms, such as unemployment compensation, welfare payments, and private charity. While low educational attainment surely is not the sole cause of low income, and therefore of all public and private aid to low income persons, it is frequently a major contributing factor. As already noted, poorly educated persons may migrate, and so may become tax burdens not on the fiscal unit which was responsible for their inadequate education during childhood, but on some external units.

Even without migration such external pecuniary effects may occur. Education costs are predominantly financed locally; but transfer payments to the poor or unemployed are often financed through higher level governments. As a result, better education at the local level may reduce welfare demands on other localities in the common fiscal unit. To illustrate: unemployment compensation is financed by state-wide tax collections; and so a community which (perhaps unwittingly) contributes to unemployment by, for example, not actively discouraging drop-outs, will thereby tend to add to the unemployment tax burdens on the remainder of the state, even if the drop-outs do not migrate.

III

We turn once again to Clayton to see what can be said about the relationships between its education activities and external financial burdens. Data on the educational attainments of Claytonians 25 and over are revealing; for although most of these adults were not educated in the Clayton Public Schools, it is reasonable to assume a close relationship between their accomplishments and the future educational attainments of their children currently being educated in Clayton schools. (If historical relationships continue, the children will be better educated than their parents.)

In 1960 the median years of school completed by Clayton adults was 13.3 compared with 10.6 for the U.S. and 9.6 for Missouri.[7] Table 7-4 shows some details behind these averages. Forty percent of Clayton adult males were college graduates, compared with 11.3 percent for the nation as a whole, and 7.9 percent for Missouri. Earlier in this chapter Table 7-1 presented the strong evidence of negative correlation between educational attainments and unemployment rates, while Chapter 4 was largely devoted to the positively correlated data on education and income. Together, these indicate that the essentially zero dropout rate from Clayton public schools, and the extraordinary educational attainments of Clayton-educated children, will bring below-average demands on the welfare purses, law-enforcement budgets, and the like, of the rest of Missouri or the area to which the Clayton-educated student may migrate.

Of the numerous forms of external cost savings resulting from Clayton education we shall now investigate one: the reduced unemployment compensation loads upon others. If some unemployment compensation taxes are not shifted to employees, additional education to some persons will benefit others -- employers or consumers or both -- by reducing the taxes

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[7] Clayton: U.S. Bureau of the Census, U.S. Census of Population: 1960, General Social and Economic Characteristics - Missouri, Final Report P C(1) - 27 C (Washington: U.S. Government Printing Office, 1962), Table 73, p.27-227; Missouri: Ibid., Table 47, p. 27-191; U.S.: Ibid., U.S. Summary, Final Report P C(1) - 1 C, Table 76, p. 1-207.

Table 7-4

Percentage Distributions of Years of School Completed by the Population, 25 Years Old and Older, Clayton, Missouri, the State of Missouri, and the United States, 1960

Years of Schooling	Clayton Male	Clayton Female	Missouri Male	Missouri Female	United States Male	United States Female
Less than 8	3.7	4.8	23.7	19.3	20.0	18.0
8	9.6	12.4	26.9	23.1	18.2	16.4
9-11	9.8	12.3	16.1	17.7	19.3	20.1
12	18.2	30.6	19.9	25.0	22.1	28.9
13-15	16.7	21.1	7.3	8.0	9.8	9.2
16	40.0	18.6	7.9	4.7	11.3	6.3
Median Years	14.2	12.7	9.2	9.9	10.3	10.9

Source: See footnote 7.

required.[8] Recent analysis of the incidence of unemployment compensation taxes suggests that some *is* shifted to consumers, while much is absorbed by employers,[9] so that there does seem to be a financial interest by these "outsiders" in the education of others. It is also true that some of the tax is borne by the general public because the tax reduces corporate profits and, thereby, federal profits taxes, at least in the short-run.[10]

Even if there were no federal tax offset of unemployment compensation taxes, and even if all of the tax were shifted to employees, there would still remain a financial interest by employees in general in the education of *other* prospective employees. The reason is that unemployment compensation tax liabilities of each firm are not determined *solely* by its own workers' unemployment experience, but partly by the aggregate experience of the state.[11] Thus, employees in one firm have a financial stake in the employment of workers elsewhere in the state. In addition, through migration, employees in any part of the country share an interest in the provision of adequate education in any other part of the country.

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[8] This assumes that added education reduces unemployment, and thus implicitly assumes that much unemployment is "structural."

[9] Richard A. Lester, *The Economics of Unemployment Compensation* (Princeton: Industrial Relations Section, Princeton University, 1962), p. 66.

[10] *Ibid.*

[11] For a description of the conditions under which reductions from the 2.7 percent state tax rate are permitted, see U.S. Department of Labor. *Comparison of State Unemployment Insurance Laws as of January 1, 1962* (Washington: U.S. Government Printing Office, 1962), pp. 36-40.

Let us assume for the moment that the differences in unemployment rates between Clayton and the United States are attributable solely to the differences in educational attainments of the respective labor forces previously noted;[12] in 1960 the unemployment rate for Clayton residents was 0.7 percent but the rate for U.S. white persons was 4.7 percent.[13] What is the reduction in unemployment compensation payments which result from the high educational attainments and low unemployment rates of Claytonians?

We have estimated the average number of weeks of unemployment per member of the Clayton labor force in 1960, under the alternative assumptions that the Clayton and the U.S. unemployment rates applied to Clayton; the findings were that if Clayton had the same level of unemployment (and presumably education) as the U.S., there would have been 1.8 additional weeks of unemployment per member of the Clayton labor force.[14] At the average weekly Missouri unemployment compensation rate of $28.61,[15] this means that except for the high level of Clayton educational attainments, there would have been paid approximately $30

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[12] This is certainly not correct in the extreme form in which it is stated. To cite one piece of evidence: while the median years of school completed by persons 25 years of age and older in 1960 was greater for the U.S. than for Missouri (10.6 _versus_ 9.6, as previously noted), the unemployment rate was lower in Missouri (3.7 percent _versus_ 4.7 percent). (Unemployment rates were obtained from U.S. Bureau of the Census, _1960 Census, General Social and Economic Characteristics -- Missouri_, _op. cit._, Table 32, p. 27-156, and _Ibid._, _U.S. Summary_, _op. cit._, Table 82, p. 1-213.)

[13] _Ibid._, Missouri, _op. cit._, Table 73, p. 27-227, and _Ibid._, _U.S. Summary_, _op. cit._, Table 82, p. 1-213. Since there are very few non-whites in Clayton, it seems appropriate to compare the Clayton unemployment rate with the "whites only" rate for the U.S.

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[14] The method of computation involved the following steps: (1) average weeks worked per person in the Clayton labor force in 1960 was estimated as a weighted average of actual weeks worked by each portion of the labor force. Since data were reported by classes of weeks worked, mid-points were used to represent the classes (U.S. Bureau of the Census, 1960 Census, General Social and Economic Characteristics -- Missouri, op. cit., Table 76, p. 27-262). (2) The estimate obtained in step 1 -- 42.3 weeks for white persons -- was divided by the complements of the national unemployment rate, 100.0 minus 4.7 percent, and the Clayton unemployment rate, 100.0 minus 0.7 percent. This provided estimates of the average weeks in the labor force per labor force member in 1960, under the assumption that everyone in the labor force was unemployed either the national or Clayton average percentage of the year. (3) The differences between the weeks in the labor force (step 2) and the weeks employed (step 1) gave the two estimates of average weeks unemployed. Thus:

$$\frac{\text{42.3 average weeks worked}}{\text{1.000-0.047 (proportion unemployed in U.S.)}} \quad -42.3 = 44.4 \quad -42.3 = 2.1;$$

$$\frac{\text{42.3 average weeks worked}}{\text{1.000-0.007 (proportion unemployed in Clayton)}} \quad -42.3 = 42.6 \quad -42.3 \underline{= 0.3}$$

Differences in average weeks unemployed 1.8

(Thanks are due T. A. Finegan for his suggestion of this procedure.)

[15] U.S. Bureau of the Census, Statistical Abstract of the United States: 1961 (82nd edition), (Washington: U.S. Government Printing Office, 1961), Table 383, p. 280.

of additional unemployment compensation paid per Clayton labor force member in 1960. For, say, 40 years of lifetime labor force participation, this annual saving in Clayton's unemployment compensation requirements has a present value of $875 at the time the high school education is completed (using a 5 percent rate of discount), or around $650 some six years earlier at the age mid-point of the entire school population ($490 and $275 at 10 percent, respectively). If as little as 50 percent of the 1960 Clayton student body of 2,067 students[16] eventually spends an average of forty years in the labor force, the saving in unemployment compensation requirements resulting from their higher than average educational attainments has a 1960 present value of some $672,000 (at 5 percent; $285,000 at 10 percent). Most of this value will benefit outsiders for reasons discussed above.[17]

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[16] Superintendent, St. Louis County Public Schools, *Ninth Annual Report of the St. Louis County, Missouri, Public Schools* (Clayton, 1960), p. 30.

[17] With respect to the portion of the unemployment compensation tax borne by employers, it is worth noting that only around 15 percent of the Clayton labor force works in Clayton. (A local study in 1956 disclosed 1,003 Claytonians working in Clayton; the 1960 Census found 6,774 Claytonians in the labor force. [U.S. Bureau of the Census, *1960 Census, General Social and Economic Characteristics -- Missouri*, *op. cit.*, Table 93, p. 27-227.] If the 1956 findings were still approximately correct in 1960, 15 percent of the Clayton labor force worked in their own community.)

At this point we might drop the assumption that all of the observed differences in unemployment rates and hence in unemployment compensation requirements are caused by differences in educational attainments. If, instead, we assume that perhaps 60 percent are attributable to educational differences,[18/] then the present value of the lifetime unemployment compensation "savings" stream will be reduced, accordingly, to $403,000 ($170,000). Thus, entirely apart from any subsequent migration of current Clayton students, there will be pecuniary benefits, almost entirely external, amounting to over $400,000 in present value terms (at 5 percent), as a result of better than average employment prospects for Clayton students.

Instead of estimating the unemployment compensation savings in terms of the differential unemployment rates between Clayton and the U.S., we might estimate the saving in terms of the differential unemployment rates between high school graduates and persons with little or no formal schooling. The latter approach would follow the precedents of previous chapters.

[18/] The issue here is the proportion of the differences in unemployment that are attributable to differences in education. Previously, we considered the proportion of the differences in income that are attributable to education, and we assumed that it was 0.6. While the two relationships are not identical, they seemed similar enough to justify using the same adjustment factor.

According to Table 7-1, the unemployment rate in March 1959 was around 12 percent for persons with no school years completed and less than half of that for high school graduates who received no higher education.[19] The average duration of unemployment for the two groups was approximately 4.6 and 2.5 weeks, respectively.[20] At $28.61, the annual unemployment compensation saving was $60 per child, and the present value of the lifetime saving was $1,000 (at 5 percent, $590 at 10 percent). Again, if 60 percent of the saving could be attributed to education and if the saving applied to only half of the 2,067 students over a working life of 40 years, then, discounting back to the mid-point of the school population's ages, these external pecuniary benefits of 12 years of schooling would amount to $465,000 ($205,000).

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[19] These percentages were for persons of all races; separate data for white persons were not available.

[20] These were computed as in footnote 14, using Survey Research Center data to estimate average weeks worked (University of Michigan, Survey Research Center, 1960 Survey of Consumer Finances /Ann Arbor: University of Michigan, 1961/, Table 1-9, p. 19.) It should be noted that the data for the less educated group, referred to above as "persons with no years of school completed," actually pertain to persons with a grade school education *or less*. The Survey Research Center notes that less than 2 percent of all the persons surveyed had no formal schooling whatsoever (*Ibid.*, p. 20). Accordingly, the unemployment rate for the 1 to 4 years of education group (from Table 7-1) was used instead of the rate for no education.

This analysis of the relationship of education to unemployment compensation requirements was intended only to illustrate the nature of external pecuniary benefits of education, and to suggest the possible magnitudes involved. Quantification difficulties prevented measurement of other forms of external pecuniary benefits as well as of the external real benefits discussed earlier. Their omission does not imply that they are unimportant.

Chapter 8

External Non-Monetary Benefits

Education is much more than a means of raising productivity or otherwise bringing financial returns. It is also a means of inculcating children with standards of socially desirable attitudes and behavior, and of introducing children to new opportunities and challenges. In our society it helps to develop greater awareness of, and ability to participate effectively in, the democratic process. In so doing, education produces benefits for the entire society, not for the students alone. As one writer put it:

> ...the gain from the education of a child accrues not only to the child or to his parents, but to other members of the society; the education of my child contributes to other people's welfare by promoting a stable and democratic society. Yet it is not feasible to identify the particular individuals (or families) benefited or the money value of the benefit....[1]

In this chapter we shall explore some evidence of the contribution of education to the effective functioning of a democratic society. The statistics to be presented will, of course, not prove that education itself brings about a stronger democracy, but the relationships between people's educational attainments and their participation in activities that help make a democracy strong are striking. Moreover, we should emphasize that the relationships studied below are merely a few of the multitude of non-monetary benefits of education, some of which have been considered briefly in Chapter 3.

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[1] Milton Friedman, "The Role of Government in Education," in *Economics and the Public Interest*, Robert A. Solo, editor (New Brunswick: Rutgers University Press, 1955), p. 125.

For one thing, education appears to develop in people a sense of citizen duty. Measuring attitudes toward citizenship duty on a five level scale which involved ranking responses to a series of questions probing the respondents' opinions about the importance of voting,[2] Survey Research Center interviewers found that only 25 percent of the grade school graduates were classified in this top level, while 50 percent of the high school graduates and 60 percent of the college graduates achieved it; none of the college graduates was in the bottom level, though 2 percent of the high school graduates and 12 percent of the grade school graduates were.[3]

Similarly favorable effects of education have been found in the relationship between education and the degree of political participation. A four level scale was devised measuring participation in terms of active membership in and work for political organizations, financial support of parties or candidates, attendance at political meetings, and so forth.[4]

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[2] V. O. Key, Jr., Public Opinion and American Democracy (New York: Alfred A. Knopf, 1961), pp. 324-25; Angus Campbell, Gerald Gurin, and Warren Miller, The Voter Decides (White Plains, New York: Row, Peterson and Co., 1954), pp. 194-99.

[3] Key, op. cit., Table 13.3, p. 325. These data were compiled from Survey Research Center studies in 1952 and 1956. See Campbell and others, op. cit., Table B.2, p. 197; and A. Campbell, W. Miller, Philip Converse, and Donald Stokes, The American Voter (New York: John Wiley and Sons, Inc., 1960), Table 17-5, p. 480.

[4] Key, op. cit., pp. 564-65.

The results showed that 20 percent of the grade school graduates, 30 percent of the high school graduates, and 45 percent of the college graduates were classified in the top level. The corresponding percentages in the bottom level were 35, 20, and 5.[5/]

Actual voting is another manifestation of democratic action that is positively correlated with level of education, and we may presume, is encouraged through education. Table 8-1 shows that for both males and females, in the South and in the non-South, and at all ages, the percentage of persons who vote increases with educational attainment.

A positive relationship between voter participation and education was also found in our own analysis. Data on voter participation in the 1952 Presidential election for the 48 states were correlated with (1) the median years of education of the population 25 years of age and older, for 1950, and (2) the percentage of the state population which was urban. The latter variable was included to isolate the presumably greater difficulty of voting for persons in rural areas. The *simple* coefficient of determination, r^2_{13}, of percentage of voter participation, X_1, and median level of schooling, X_3, was 0.421, indicating that schooling "explained" 42 percent of the interstate variance in voter participation. But when the percentage of population urbanized, X_2, was held constant, the *partial* coefficient of determination, $r^2_{13.2}$, was found to be 0.612;

5/ *Ibid.*, Table 13.9, p. 331, and Campbell and others, *The American Voter*, *op. cit.*, Table 17-8, p. 490.

61 percent of the interstate variance not explained by urbanization was explained by schooling. (Urbanization alone explained virtually none of the variance in voter participation -- $r_{12}^2 = 0.000$.)

Better-educated persons not only have better voting records, but they also are apparently more anxious to discuss political issues and thereby to influence the votes of others. This is indicated in Table 8-2. Insofar as persons with more education are more informed about political issues, and are more anxious to see that other people become informed, their desire to influence other voters is a socially commendable result of their education.

The brevity of this chapter does an injustice to the important and sometimes subtle ways that education strengthens our democratic institutions. No attempt has been made here to be thorough in an area in which economists can probably contribute little. Instead, the modest goal has been to demonstrate our recognition of the fact that benefits from education may indeed take many forms, some of which -- and possibly the most important -- defy measurement in money terms.

Table 8-1

Percentage of the Population Voting for President in the 1952 and 1956 Elections, by Age, Education, Sex, and Region

	Non-South			South		
Age and Sex	Grade School	High School	College	Grade School	High School	College
Less than 34						
Male	60% (52)	78% (175)	88% (81)	19% (32)	55% (69)	81% (32)
Female	44 (55)	73 (285)	90 (90)	13 (47)	41 (111)	74 (23)
34-54						
Male	80 (156)	87 (222)	96 (103)	55 (87)	80 (54)	88 (33)
Female	71 (170)	85 (312)	91 (85)	22 (97)	56 (86)	82 (38)
55 and over						
Male	87 (179)	93 (96)	100 (31)	63 (72)	71 (21)	82 (11)
Female	71 (173)	91 (126)	93 (30)	31 (75)	58 (33)	86 (22)

Note: Sample sizes are in parentheses.

Source: Campbell and others, The American Voter, op. cit., Table 17-11, p. 495.
See also their Table 17-2, p. 478.

Table 8-2

Education and "Opinion Leaders" -- Percentage of Persons Who Tried to Influence the Votes of Others, by Level of Education and Region, 1956

	Non-South			South		
Percentage Who Tried to Influence	Grade School	High School	College	Grade School	High School	College
Votes of Others	20 (362)	29 (654)	45 (232)	19 (178)	27 (232)	34 (99)

Note: Sample sizes are in parentheses.

Source: Campbell and others, The American Voter, op. cit., Table 17-1, p. 477.

Chapter 9

Spill-over Effects and the Allocation of Resources to Education

In this chapter, we first review the theoretical framework within which the preceding material on benefits of education has been viewed. Then we present a hypothesis regarding the effects of benefit spill-overs on resource-allocation and education-finance decisions, draw out some implications of the hypothesis, and test them against some United States data.

I

We have pointed out that if one area provides education, but the benefits accrue to outsiders, a spill-over, or external benefit, may be said to occur. Spill-overs may be important for two reasons: Considerations of equity in the finance of education may suggest that external beneficiaries ought to share in the financial burden of education; considerations of efficiency in resource allocation suggest that if benefits received externally are disregarded by decision-makers (voters or political leaders), then under-expenditure will result. This chapter deals with the effects of benefit spill-overs on both the actual means of financing public education, and on the actual level of support for it. It is a study in positive economics -- that is, a study of what will and does happen as a result of spill-overs of education benefits. It is not concerned with the ethical issue of how education ought to be financed, except insofar as the means of finance may influence the level of finance.

Spill-over benefits of education have been seen to take a number of forms: (A) *Additional lifetime income* (productivity) generated by education may be lost to the community through out-migration. (B) Taking a narrower view, *additional local taxes* paid out of the additional income may similarly be lost through migration. (C) Benefits of education may take the form of *reduced social costs* of other activities; inadequate education appears to contribute to low income, which is associated with delinquency and crime. Thus, education may provide social benefits by freeing some resources now devoted to law enforcement and allied activities. (D) Education may also benefit persons other than those being educated, by causing *reduced transfer payments* to low income people, whose low income is to some extent attributable to inadequate education; such payments as unemployment compensation and relief, while not resource costs to the society, are private costs to the payers. Thus, reduction of these costs would constitute a benefit of education from their viewpoint. (E) Some benefits from education may be in *non-monetary* form. Indeed it may be true that public support for locally provided education reflects, in part, a desire to inculcate children with the social norms and values of the community.[1] If the average child could be expected to spend most of his adult life in that community, even non-parents would have an incentive to support education as training in "good citizenship" for their future neighbors. The fact that it is difficult to make a monetary estimate of the value of this good-neighbor, good-citizenship benefit should not lead us to assume the value is zero. Whatever the value, it is lost to that community if out-migration occurs, ceteris paribus. As we have seen, spill-overs of types (C) and (D) may occur even without migration if persons in different communities are fiscally interdependent.

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[1] Thus, the Ordinance of 1787 justified public financial support of education on the grounds that "Religion, morality, and knowledge [are] necessary to good government and the happiness of mankind...." (Arvid J. Burke, *Financing Public Schools in the United States* [New York: Harper and Brothers, 1951], p. 245). Since concepts of "morality" and "religion" might vary among areas, local determination of curriculum content and other educational variables seemed to be called for.

In previous chapters we have analyzed these benefits of education and, where possible, estimated their spill-over component. Now we raise the question of whether the presence of benefit spill-overs is likely to exert any influence on the level of expenditures or on the means of education finance or on both. Specifically, we seek to test the hypothesis that support for education is based not on elusive ill-defined social attitudes, but on the expectation of returns.[2] According to this hypothesis, external returns (spill-over benefits) which could not be captured by the decision-makers would be disregarded -- that is, would be regarded as losses of benefits by the original area. Thus, spill-overs would exert some predictable marginal influence on the means and level of support for public education; these are considered in some detail below.

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[2] An analysis of the political process in terms of a cost-benefit calculus has been made by Anthony Downs in his An Economic Theory of Democracy (New York: Harper and Brothers, 1957).

The use of a highly rationalistic welfare-maximization model does not imply a belief that voters actually and carefully weigh costs and benefits, and consider spill-overs explicitly in the process of reaching decision. Rather, the interpretation is that they behave collectively as if they were maximizing. One implication of the "maximization" hypothesis is that areas experiencing substantial out-migration of locally-educated persons should be noting this "loss," and complaining about it. And they are. For example, a North Carolina publication dealing with the state's economic growth states: "We invest thousands of dollars in rearing and educating growing people -- only to find them migrating to other areas."[3] The same lament is being voiced with respect to international migration, particularly of the more highly-trained workers. In Britain, for example, there is real concern about the loss of scientists, "who have been educated in British universities mainly at Government expense...."[4] Moreover, the act of education itself seems to increase population mobility; at least it is true that Census Bureau figures show a positive correlation between educational attainments and migration rates.[5]

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[3] "Decisions for Progress," (Raleigh: Agricultural Policy Institute, North Carolina State College, n.d. /circa 1961/, p. 4.).

[4] George Louis Payne, Britain's Scientific and Technological Manpower (Stanford: Stanford University Press, 1960), p. 375.

[5] See the table in footnote 10, Chapter 4, above.

Just as one implication of the maximization model of the determinants of education expenditures is that there will be complaints about spill-overs of benefits, so a second implication is that the complaints will be translated into actions. Specifically, the growing geographic mobility of the U.S. population should become manifested in growing pressure by local communities to get external beneficiaries to share in financing education. Thus, our model would predict a secularly rising percentage of public education expenditures coming from higher-level governments. Table 9-1 is consistent with this prediction. The share of total public school expenditures coming from state governments and the share coming from the federal government are both rising.

If the data in Table 9-1 reflect, even in part, the adjustments of education-finance to increasing spill-overs of education benefits, then it should be the case that other, non-education, expenditures, which presumably involve less spill-over effects, should be rising less rapidly at the state level than at the local; that is, transfer of responsibility from local to state governments should be less for non-education expenditures. Thus, the ratio of local to state-plus-local expenditures for non-educational purposes should be rising through time, or at least not falling as rapidly as it is for education.6/

6/ Spill-over effects are, after all, not limited to education expenditures; for example, they certainly exist for highway expenditures.

Table 9-1

Distribution of Total Revenue of Public Schools by Level of Government, 1920-1960

School Year Ending	Percent of Total Revenue Coming From Each Level of Government		
	Local (1)	State (2)	Federal (3)
1920	83.2	16.5	0.3
1930	82.7	16.9	0.4
1940	68.0	30.3	1.8
1950	57.3	39.8	2.8
1961	56.3	40.1	3.6

Source: 1961 data: National Education Association, Estimates of School Statistics, 1960-61, Research Report 1960-R15, p. 29.

All other data: U.S. Bureau of the Census, Historical Statistics of the United States, Colonial Times to 1957, (Washington, D.C.: U.S. Government Printing Office, 1960), p. 208.

Table 9-2 indicates that this is another implication of the maximization hypothesis which is consistent with the facts. Comparing the percentages in Table 9-2 with those in Table 9-1, column 1 (and disregarding the fact that Table 9-1 considers federal expenditures while Table 9-2 does not), we find that whereas both local education expenditures and non-education expenditures were around eighty percent of the respective "total" government expenditures around 1930, by thirty years later the education figure had fallen below sixty percent, while the non-education figure was above seventy percent. Although the data in

Table 9-1 and 9-2 are consistent with our hypothesis, of course they do not prove that it is correct. Other factors are also involved.

If spill-overs are depressing the historical dependence of education on local support, then we might expect to find a cross-section relationship. That is, a third implication of the maximization hypothesis is that there will be a positive correlation between the level of out-migration from an area and the proportion of its public education supported by non-local governments. This was tested by a simple rank correlation of the twenty-eight states which had net out-migration during the 1950-58 period: Percentage of the 1950 population out-migrating (net) was correlated with percentage of (1960) public (elementary and secondary) education expenditures financed by the state governments. As predicted, a positive rank correlation was found; $r_s = +.36$, which was different from zero at the five percent level of significance, and in the expected direction.

Because a number of the out-migration states were in the South, and there might be some reason unique to the South for having a high level of state aid for education, the correlation was performed again omitting these states. Seventeen states remained. The rank correlation for them was still positive, .26, though not significant at a five percent level.[7]

The implications of the maximization model which have been discussed so far have dealt with the likely effects of spill-overs on the distribution of education support by level of government. But the model also implies that insofar as fiscal arrangements fail to bring all of the beneficiaries of education within the decision-making unit, spill-overs will affect the level of education support. The anticipation of out-migration of locally educated children may be expected to exert a depressing influence on education expenditures, since most of the benefits from education will be lost to the origin area. Probably the clearest case in which a community or state can expect to benefit little, if at all, from its educational activities involves migrant labor. Most monetary and non-monetary benefits alike will be realized elsewhere. Therefore, lack of concern for the education of children of migrant laborers is all too understandable in terms of local self-interest, and so their inadequate education has come to be seen as a problem of national concern.[8]

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[7] For significance at the five percent level with seventeen observations, r_s must be at least .48.

Even if the anticipated out-migration is among the current group of adults, rather than the current children, the same depressing effect should be felt; if today's adults (other than parents of public school children, of course) expect to leave the area, they may feel they have little to gain from investing now in the area's children. Thus, the model forecasts a negative correlation between public education expenditures per pupil and "degree" of out-migration, other things being equal.

8/ U.S. 87th Congress, 1st Session, Senate Committee on Labor and Public Welfare, Subcommittee on Migratory Labor. Hearings on S. 1123, S. 1124, S. 1125, S. 1126, S. 1130, and S. 1132, Volume 1 (Washington: U.S. Government Printing Office, 1961).

Table 9-2

Local Government Expenditures as a Percentage of Total Local Plus State Expenditures for Purposes Other Than Education, Selected Years, 1927-1957

Year	Local as Percentage of "Total" Expenditures (Excluding Education)
1927	79.4
1940	73.0
1950	70.0
1957	72.5

Note: "Total" expenditures are for "current operations" only.

Source: Computed from data in Historical Statistics of the United States, Colonial Times to 1957 (Washington: U.S. Government Printing Office, 1960), series 604, 617, 673, 690.

A statistical test of this prediction is described below.

It is interesting to recall, as discussed in Chapter 1, that although the model forecasts that out-migration will tend to depress per-pupil expenditures on education, it does not necessarily forecast the converse proposition -- that in-migration will tend to augment spending. The argument may not be symmetrical. In-migration to area A may, indeed, bring benefits from the education provided elsewhere; but to the extent that these "spill-ins" are independent of the education expenditures in **A**, the spill-ins are a "fixed" benefit.[9] As such they will not affect decisions at the margin. The conclusion is two fold: (1) anticipated out-migration tends to depress education expenditures per student; but (2) anticipated in-migration has no effect. If this reasoning is correct, there is a chronic tendency to underinvestment in education for any one area and for the nation as a whole, unless higher level governments step in, or lower level governments are expanded geographically so as to internalize the spill-over benefits. The declining number and growing size of school districts illustrate the latter form of adjustment, though there may well be additional reasons for the consolidation of school districts.

II

The two implications of the welfare-maximization hypothesis enumerated in the last paragraph have been subjected to a test using a linear multiple regression model. A regression was run of current expenditure per public school student against a number of "independent" variables in an attempt to impound the influence of other factors so that the effect of migration on the education expenditures could be investigated, ceteris paribus. The variables, and the justification for including each, were as follows:

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[9] The assumption that population location decisions are not influenced substantially by the level of education expenditures is discussed further below.

X_1: the dependent variable -- current expenditures on public education per public school student.

X_2 and X_3: federal aid and state aid, respectively, as a percentage of total public school current expenditures. These were included so as to determine whether there was any systematic relationship between the level of expenditures and the proportions of the totals coming from state and federal governments.

X_4: total personal income in the fiscal unit, per public school student (in units of ten dollars). This is designed to measure capacity to support education. It reflects the age distribution of the population, too, because an area of given total population will tend to have lower aggregate and per student income the greater the percentage of children. The expected sign of the coefficient of X_4 is positive.

X_5: percentage of the school-age population (6-17 years old) in public schools. This is designed to indicate any negative attitudes toward public education by parents of non-public school children. Thus, it is an indicator of "willingness" to support public education, just as X_4 is an indicator of "capacity" to support it. We would expect the coefficient of X_5 to be positive.

X_6: public high school students as a percentage of total public school students. Since high school education is more expensive than elementary education, it was felt that expenditure "needs" might vary between areas by virtue of their different age distributions of children; therefore, a positive sign is forecast for the coefficient of this variable.

X_7: non-white enrollment in public schools as a percentage of total public school enrollment. If racial attitudes affected willingness to support public education, this variable would be expected to reflect it, and so the coefficient of X_7 would be negative.

X_8 and X_9: percentage change in population resulting from net in-migration, or from net out-migration, respectively. The migration factor was stated as two variables rather than one in order to test the hypothesis that in- and out-migration have asymmetrical effects. For any given observation there cannot be both net in- and net out-migration; thus when net in-migration has occurred, the value for X_8

will be positive, while the value for X_9 will be zero; when net out-migration has occurred, the value of X_8 will be zero while the value of X_9 will be positive. 10/

The eight independent variables may be classified as those measuring "ability to spend" (X_4), "need to spend" (X_6), and "willingness to spend" (all others). All data used in the statistical test were for the forty-eight adjacent states around 1960, except for the migration data, which covered the period April 1, 1950 to July 1, 1958. 11/ Since the expenditure data are for around 1960, our use of migration data for an earlier period (the latest available) thus assumes implicitly that the recent migration patterns are expected by decision makers to continue.

10/ Previous econometric studies of determinants of expenditures for education have included explanatory variables similar to X_2 through X_7, but they have not included variables such as migration, which indicate benefit spill-overs. (See Sherman Shapiro, "Some Socioeconomic Determinants of Expenditures for Education: Southern and Other States Compared," Comparative Education Review, 6 /October 1962/, pp. 160-66; Werner Hirsch, Analysis of Rising Costs of Public Education, Study Paper No. 4, Joint Economic Committee, U.S. Congress /Washington, D.C., 1959/, pp. 30-32, 35-37; Edward Renshaw, "A Note on the Expenditure Effect of State Aid to Education," Journal of Political Economy, LXVIII /April 1960/, pp. 170-74.)

11/ Sources of the data are as follows:

X_1: Research Division, National Education Association, Rankings of the States, 1961 (Washington, 1961), Table 42, p. 27.

X_2: Ibid., table 40, p. 26.

X_3: Ibid., table 27, p. 22.

X_4: Ibid., table 53, p. 33.

X_5: Ibid., table 10, p. 11.

X_6 and X_7: U.S. Bureau of the Census, U.S. Census of Population: 1960, General Social and Economic Characteristics, various states, Final Reports PC(1)-2C through PC(1)-52C (Washington: U.S. Government Printing Office, 1962), table 46.

X_8 and X_9: U.S. Bureau of the Census, Current Population Reports, Population Estimates, "Estimates of the Population of States and Selected Outlying Areas of the United States, July 1, 1958 and 1957," Series P-25, No. 208, December 7, 1959, table 3, p. 6.

Data on gross, rather than net migration might have been utilized, but they were not available. The effects of migration hypothesized above can be viewed in terms of net migration; in this case, the reasoning might be that the area or community considers out-migration of locally educated people to represent a loss only if the people are not replaced -- that is, only if net out-migration occurs; but that beyond "replacement," in-migrants are not viewed as representing benefits to the destination area from its own education.

Alternatively, the hypothesis could be stated strictly in terms of gross migration to and from an area; to test this conception of the importance of out-migration but unimportance of in-migration as influences on expenditures per student, data on gross migration are required. Net figures may still be useful, though, if it can be assumed that reasonably high correlations exist between net and gross in-migration, and between net and gross out-migration.

Still another problem exists with respect to the migration data. The data are for states, but the hypothesis indicates an effect of out-migration on the unit financing education; and in the main, this means the local school district, although the importance of state support is considerable in some states. State migration data may reflect inadequately the relative migration from local school districts in various states. It is possible for a state to have very little out-migration (whether gross or net is not relevant here), but a great deal of internal migration between communities. The latter would cause us to expect a relatively low level of local education expenditures, or a shift of financial responsibility from local to state government, but the state data, which would show little out-migration, would indicate no relationship between out-migration and expenditures. Thus the use of state migration data presupposes a rather high correlation between inter-state and intra-state population movement. A priori this seems to be a reasonable assumption.

It is, of course, a matter of judgment as to how serious the shortcomings of the data are. It is inevitably true that the data available to test a proposition do not correspond precisely to the theoretical constructs. In the present case the data appear to be useful for testing the hypothesis, although additional tests with other data should also be undertaken -- in particular for sub-state regions, ideally school districts.

The welfare-maximization model predicts that in a multiple regression analysis in which other determinants of public education expenditures are held constant, (1) the coefficient of variable 8, in-migration, will be not significantly different from zero, while (2) the coefficient of variable 9, out-migration, will be significantly negative. That is, assuming a continuation of the 1950-58 migration pattern, those states which anticipate out-migration will have expenditures per student lower than otherwise expected, but states which anticipate in-migration will have expenditures per student equal to those otherwise expected.

The regression equation obtained is as follows, with standard errors in parentheses:[12]

$$X_1 = -15.69 - \underset{(3.26)}{1.71X_2} + \underset{(0.44)}{0.23X_3} + \underset{(0.04)}{0.18X_4} + \underset{(1.26)}{1.80X_5}$$

$$+ \underset{(4.45)}{9.18X_6} - \underset{(0.84)}{1.05X_7} - \underset{(0.62)}{0.11X_8} - \underset{(1.63)}{4.04X_9}$$

The coefficients of variables X_4 through X_7, have the expected signs. The coefficients of variables X_2 and X_3, about which there were no a priori expectations, are clearly not significantly different from zero. However, the coefficients of variables X_4 and X_6 are significant at better than the five percent level, and the coefficients of X_5 and X_7 are significant at the eight and eleven percent levels, respectively.[13]

Now we turn to the two migration variables, X_8 and X_9. As predicted, the coefficient of variable X_8, in-migration, is not significantly different from zero. Also as predicted, the coefficient of variable X_9, out-migration, is negative, and is significant at the one percent level. The coefficient of X_9, -4.04, indicates that a one point increase in the percentage of the population net out-migrating is associated with a $4.04 decrease in public education expenditures per student (1.1 percent of the \$370 mean expenditure for all states in 1959-60). Arkansas, for example, which had 22 percent net out-migration, was predicted to spend 22 times \$4.04, or \$89, less per student than if it had no out-migration, ceteris paribus. Since Arkansas actually spent \$242 per student, out-migration apparently contributed a 27 percent reduction in its expenditure. This is an extreme illustration, but it shows that the impact of out-migration may not be negligible, at least according to the relationships we have found.

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[12] The coefficient of multiple determination, R^2, is 0.78. The coefficients of partial determination are:

$r^2_{21.3456789} = 0.01$

$r^2_{31.2456789} = 0.01$

$r^2_{41.2356789} = 0.40$

$r^2_{51.2346789} = 0.05$

$r^2_{61.2345789} = 0.10$

$r^2_{71.2345689} = 0.04$

$r^2_{81.2345679} = 0.00$

$r^2_{91.2345678} = 0.14$

[13] Using a single-tail t-test. The single-tail test is appropriate since the signs of the coefficients had been predicted.

Let us return now to the federal and state aid variables (X_2 and X_3), which have been found to be of no assistance in explaining the variance in state education expenditures. With respect to the federal aid variable, the maximization hypothesis seems to imply that the anxiousness of a state to seek federal aid for its education would be a function of the magnitude of its spill-overs, and thus of its out-migration. However, this prediction follows from a model in which behavior is determined solely by considerations of expected monetary returns; and we know that in the real world every discussion of federal assistance for elementary and secondary education arouses emotions concerning segregated schools and parochial schools. For this reason there might be no relationship between the size of a state's benefit spill-outs and its pursuit of federal aid, even if there were a federal program which permitted a state to receive aid according to its spill-outs.

With respect to the state aid variable, our hypothesis appears to hold no implications about any relationship between it and the level of education expenditures in the state. However, if local community migration data were used, the hypothesis would have another testable implication. It is this: if spill-overs were occurring but communities were not successful in getting the states to accept a sufficiently great share of the financial burden, then we would expect to find two relationships -- (1) little or no positive correlation between out-migration, X_9, and the percentage of that community's expenditures coming from state aid, X_3; but, as a result, (2) a strong negative correlation between out-migration and the level of expenditure per student, X_1. The point is simply that the smaller the degree to which effective fiscal relationships have been developed so as to internalize benefit spill-overs, the greater the likely effect of those spill-overs on the level of expenditures.

If it is reasonable to assume that inter*state* migration, for which we have data, is a satisfactory proxy for inter*community* migration within that state, then the test suggested in the previous paragraph can be performed. As reported earlier in this chapter, we have found a statistically significant negative correlation between out-migration and expenditure level -- relationship (2), above; thus we should expect to find little or no positive relationship between out-migration and state aid -- relationship (1). And this is the case. When the regression was run using state aid as the dependent variable, the coefficient of the out-migration variable was -0.16, with a standard error of 0.63.

By this point the reader may charge that we are trying to wring too much from the data. To be sure, our interpretations of the findings are conjectural and replete with questionable assumptions. At the same time it is remarkable how many testable implications the welfare-maximization hypothesis provides, and how consistent the data are with them. The desirability of further testing is clear.

Needless to say, the fact that statistical findings are consistent with the predictions of a model which views public education as an investment does not prove that the model describes accurately either the behavior or the conscious motivation of decision makers. Moreover, education expenditure decisions are made as part of a political process in which majority voting determines many actions. A political unit may not have the freedom of a firm to maximize, and so our assumption that public education is supported as if it were an investment is open to question. Yet it must be kept in mind that the consciousness of the motivation -- the "realism" of the assumptions -- is not really at issue; the insights and predictions of the model are.

Alternative explanations for the phenomena cited above are not hard to develop. Indeed, if objections to the maximization model are raised, they should take the form of alternative models which offer either (1) simpler explanations for the same evidence; or (2) explanations for a wider range of phenomena. Our confidence in the usefulness of the model will grow or diminish as additional tests of its implications are passed or failed.

In this chapter several sorts of evidence were cited, all of which were implied by the maximization model as applied to a case in which benefit spill-overs occur. The evidence of public complaints about alleged losses due to out-migration of "domestically" educated people might be explained as parochial foolishness or as rationalizations for persons anxious to keep taxes low, just to mention two alternatives to the maximization hypothesis.

The evidence of rising percentages of public school funds coming from non-local governments might be explained by growing public concern over inequalities of income and wealth, and the resulting inequalities of opportunity. Such "growing concern" could reflect an assumption that the inequality of income is increasing, although most evidence indicates that it is not;[14] or it could reflect growing awareness of the existing inequality.

The findings of the statistical relationships between out-migration and level of support for education are also subject to alternative explanations. The maximization model assumes implicitly that migration patterns are determined exogenously, and that education expenditures adjust to those patterns. Alternatively, one might assume that migration is determined endogenously -- that it is determined, at least in part, by the level of education expenditure. High level expenditures might attract people, low level expenditures might repel them. If this were the case, the coefficient of partial correlation of out-migration and expenditures per student would be negative, as we have seen it is. But then the coefficient of partial correlation of in-migration and expenditures would be positive, and this is not consistent with our finding of an essentially zero correlation.[15] To test further the hypothesis that high level expenditures attract population, the regression discussed above was re-run, but this time using in-migration, X_8, as the dependent variable. The object was to see whether the level of public education expenditures per student, X_1, would be significant in explaining the level of in-migration, as it should be if high expenditures attract people. The regression coefficient of -0.005 was only about one-eighth of its standard error, 0.041, which of course is insignificant, and the sign is not even in the "predicted" direction.

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[14] See, for example, Irving B. Kravis, The Structure of Income (Philadelphia: University of Pennsylvania, 1962), p. 204. But compare Robert J. Lampman, "Recent Changes in Income Inequality," American Economic Review, XLIV (June 1954), pp. 251-68.

Results might have been quite different, however, if community or school district rather than state data had been used. The level of education expenditure might exert a significant influence on location decisions within a metropolitan area, even if it had scarcely any influence between states. It should be noted, though, that education is only one component of public services, which in turn constitute only one determinant of the total location decision. Thus, the relationship between level of education expenditures (including taxes!) and over-all attractiveness of an area is by no means clear, a priori. At this point there seems to be no strong reason for rejecting the assumption implicit in the conceptual model presented in this chapter -- that mobility does influence the level of education expenditures, but not vice versa.

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[15] I am indebted to William G. Bowen for suggesting this plausible hypothesis, and for pointing out its partial inconsistency with the observed data.

III

The questions posed here were whether geographic spill-overs of benefits from public education, occurring particularly through migration, influence the means of financing public education and the amount of public resources devoted to education. Evidence was cited which suggested affirmative answers. For the reasons discussed, statistical and other, conclusions drawn from this analysis must be tentative. The findings, however, are consistent with the propositions that benefit spill-overs accompanying out-migration are tending (1) to depress aggregate expenditures on education; and, through time, (2) to shift financial responsibility for education to larger and higher-level governments. Further study is needed to determine how important are external effects in general, and out-migration in particular, in influencing the level and means of education finance. It may be true that the apparent importance found here really represents the camouflaged influence of one or more other factors. But if migration does have significant effects, important implications may exist for economic policy on the organization and financing of education.

Chapter 10

Summary, Policy Implications, and Concluding Remarks

Whereas public primary and secondary education have been considered traditionally as matters to be dealt with locally according to the preferences of each community, we have found that the effects of these local decisions permeate the entire society. Population mobility and fiscal interdependence make education decisions in one part of the nation important to other, even distant, parts.

It has not been possible to develop monetary measures of all the benefits of education to other areas, but estimates of some external benefits or economies have been made for the case study city of Clayton, Missouri, a principal suburb of St. Louis. We have tried not only to determine the degree of impact of Clayton's public education on outsiders, but also the degree of impact of outsiders' education on Clayton. Specifically we have measured external, spill-over, benefits in the form of (1) educational capital (the capitalized value of additional lifetime income resulting from education); (2) tax revenue; and, to a small extent, (3) transfer and resource savings. Table 10-1 summarizes our limited findings. The "Exports" column contains the present values in 1960 of the expected benefits to outsiders resulting from the twelve years of Clayton's public education for the 1960 student body. These values are products of the number of students and the expected exports (spill-outs) per locally educated student. The "Imports" indicate expected benefits to Clayton from education provided externally -- benefits received during the same period (students' lifetimes) that the exports are expected to occur.

With respect to the range of benefits quantified, we see that Clayton is providing substantial benefits to outsiders, and is receiving somewhat smaller aggregate returns from education provided externally. However, the geographic distribution shows that Clayton is a net exporter of benefits to some areas and a net importer from others. The principal conclusions are that education does indeed benefit other areas, and that there is no necessity for the benefits from and to any particular community to be equal.

In Table 10-1 the "Educational Capital" estimates are derived from Chapter 5, except that they are shown net of taxes, with the taxes shown separately, in order to avoid double-counting.[1] The "Other Fiscal" benefits, row 1c, involve the concepts discussed in Chapter 7; as a practical matter, however, we were able to quantify only one of the variety of external benefits analyzed there -- namely, reduced unemployment compensation needs. Moreover, we were able to measure only the net, or balance, of Clayton's benefits in this form, and we were not able to determine the geographical distribution. To make the distribution it would have been necessary to investigate complex issues of the manner in which any reduction in the

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[1] See the discussion of this point in Chapter 6.

Table 10-1

Adjusted Present Values of Exports (Spill-outs), Imports (Spill-ins), and Balance (Net Spill-over) of Benefits from Twelve Years of Public Education Per Student, Clayton, Missouri, 1959-60, at Five and Ten Percent Discount Rates

Area and Form of Benefit	Exports		Imports		Balance	
	5%	10%	5%	10%	5%	10%
1. Total	$6,257	$2,331	$5,965	$2,584	$ -892[a]	$ -101[a]
a. Net Educational Capital	5,927	2,219	5,642	2,455	-284	236
b. Taxes	330	112	323	129	-8	17
c. Other Fiscal	--	--	--	--	-600	-354
2. Rest of St. Louis County						
a. Net Educational Capital	3,440	1,228	2,783	1,207	-656	-80
b. Taxes	195	67	158	67	-38	0
3. St. Louis City						
a. Net Educational Capital	409	155	889	391	481	236
b. Taxes	23	6	53	17	30	11
4. Rest of St. Louis S.M.S.A.*						
a. Net Educational Capital	69	26	137	60	69	34
b. Taxes	*	*	*	*	*	*
5. Rest of Missouri*						
a. Net Educational Capital	198	73	263	113	66	39
b. Taxes	15	6	23	11	8	6
6. Rest of U.S.						
a. Net Educational Capital	1,679	634	1,387	599	-292	23
b. Taxes	98	28	75	34	-23	6
7. Foreign						
a. Net Educational Capital	124	49	177	80	53	31
b. Taxes	8	0	8	0	0	0

See next page for notes.

Notes to Table 10-1

Columns may not sum to totals because of rounding.

*Data on tax spill-overs to and from the "Rest of St. Louis S.M.S.A." are not available separately but are implicitly included with the "Rest of Missouri" and the "Rest of U.S." since the St. Louis S.M.S.A. is partly in Missouri and partly in Illinois. As a result, the "Net Educational Capital" entries for the "Rest of St. Louis S.M.S.A." are somewhat overstated, and the "Net Educational Capital" entries for the "Rest of Missouri" and the "Rest of U.S." are correspondingly understated.

a/ "Balance" totals do not equal the differences between Imports and Exports because of the inclusion of "Other Fiscal" benefits in the Balance column but not in the Exports and Imports columns. (See text for further discussion.)

Sources: Tables 5-2 and 6-4; and p. 121.

need for unemployment compensation would be shared by workers, employers, and consumers, who might live in one area, work in another, and shop in a third.

The tax data used in Table 10-1 are slight modifications of those in Table 6-4. The latter are applicable to high school graduates at age 18, with future additional taxes being discounted back to that age. However, we are interested in the future benefits for the actual student body in 1959-60, and these students are at all ages between 6 and 18; their average age is approximately 12, and so we have discounted for six additional years (18-12) the tax benefits in Table 6-4 prior to entering them into Table 10-1. This modification had already been made to the "Other Fiscal" benefits in Chapter 7.

The treatment of tax spill-overs in Tables 10-1 and 10-2 is incomplete. Although we have included the tax spill-overs created through migration, we have omitted those created by fiscal interrelationships, which were discussed in Chapter 6. In Table 6-3 we estimated the spill-outs of these taxes, but were unable to estimate the corresponding spill-ins. Therefore, we have omitted this particular item completely rather than bias the "balance of trade" presented in Tables 10-1 and 10-2. An impression of the significance of the omission may be obtained by comparing the migration tax spill-out of $330 per student -- which does appear in Table 10-1 -- with the fiscal tax spill-out of $2,670 -- which does not. Of course there are many other omissions from the study; and we have included in the summary only those few spill-overs which we have been able to estimate.

While the present study deals only with benefits of public education, a companion study is investigating costs, and is looking in particular at expenditures in Clayton during the 1959-60 school year. The extent to which the burden of these single-year costs is shifted to persons outside Clayton is being considered, as well as the reverse shifting. In order to make the findings on benefits comparable with those on costs, our results will be translated into benefits from a single year of public education, rather than from the full twelve year investment period, as they stand now. Assuming that each year of schooling contributes equally to the ultimate value of education through high school, we shall simply take one-twelfth of the values reported in row 1 of Table 10-1 as estimates applicable to the single school year 1959-60. Then, since the figures in Table 10-1 are for a single student, we shall multiply these values by the number of students in the Clayton schools in 1959-60, 2,067. These two steps have been taken, and the results are presented in Table 10-2.

Because of the existence of external benefits, and because exports and imports of education benefits will generally be unequal for particular communities or areas, problems of allocative efficiency and distributional equity in education finance tend to arise. The prediction that allocative efficiency will be impaired by the presence of external benefits is derived from a model in which the support for public education is viewed as an investment from which returns are expected by the community; thus, insofar as some of the returns are realized externally -- that is, are not captured by the investing community -- education expenditures will tend to be sub-optimal.

Table 10-2

Adjusted Present Values of Exports (Spill-outs), Imports (Spill-ins), and Balance (Net Spill-over) of Benefits from One Year of Public Education For the Entire Public School Population, Clayton, Missouri, 1959-60, at Five and Ten Percent Discount Rates

Form of Benefit	Exports 5%	Exports 10%	Imports 5%	Imports 10%	Balance 5%	Balance 10%
1. Total	$1,077,768	$401,515	$1,027,471	$445,094	$-515,279	$-161,421
a. Net Educational Capital	1,020,925	382,223	971,831	422,874	-48,901	40,651
b. Taxes	56,843	19,292	55,637	22,220	-1,378	2,928
c. Other Fiscal	--	--	--	--	-465,000	-205,000

Source: Table 10-1.

The issue of distributional equity in the support of public education is conceptually separate from the issue of the effects of external benefits on the amount of resources devoted to public education. Whatever the level of expenditures, how should it be financed? Should external beneficiaries share in the financial support for education? Such normative questions are not amenable to resolution through economic analysis. We can, however, indicate some pressures that are likely to grow in response to deviations of the actual distribution of support for education from the publicly-desired distribution. For example, growing population mobility brings growing external effects of education, and thereby may be expected to lead to increasing efforts to shift the financial burden of education from local to higher level governments.

In this study we have investigated benefits which education of one generation brings to persons other than the students and their parents, and have suggested that the implicit if not explicit expectation of such benefits provides one explanation for public support of education, as a community investment. But alternative views of the rationale for public support of education certainly may be developed. For example, it might be held that to look only at a single generation is to neglect important intergeneration relationships; thus,

> There is a system of social compacts, written and unwritten, by which redistributions at a point in time are repaid by other redistributions earlier or later. Everyone pays for public education; those with children currently in public schools benefit a great deal. Younger families expect to benefit later when their children go to school. Older families whose children are finished with school have already benefited. 2/

The authors do recognize subsequently, however, that in addition to considering long-run inter-generation relationships, one may wish to analyze the short-run distribution of benefits.

A theory of public support for education which involves reliance on "social compacts" may be useful if developed more fully; such a theory would lead to such questions as: Is there any reason to expect older persons to support public education simply because they and their children benefited in the past? Can we expect older non-parents, or parents of children in private and parochial schools to be parties to the alleged social compact?

Meanwhile, it would be desirable to see to what extent support for public education by "non-parents" can be explained in terms of the traditional economic theory of utility or profit maximization, as has been done in this study, rather than having to resort to an *ad hoc* theory which applies only to public sector activities, and then to only a portion of them. Our findings suggest that analysis of the nature, magnitude, and distribution of benefits from public education may provide a sufficient, though certainly not a necessary, explanation for a variety of aspects of

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2/ (from previous page) James N. Morgan, Martin H. David, Wilbur J. Cohen, and Harvey E. Brazer, *Income and Welfare in the United States* (New York: McGraw-Hill Book Co., 1962), p. 290.

In the paragraph quoted the authors go on to say that the distribution of benefits in a *single year* exaggerates the long-run concentration of benefits; but it does not seem improper to cite their statement in the present context of the rationale for *continuing* support of education by persons other than parents of current or prospective public school children.

public behavior involving education, so that resort to special theories may not be needed. To be sure, this conclusion is tentative, at best.

It should be emphasized that the investment explanation for support of public education does not imply that citizens are always conscious of benefits they receive from the education of others; it does not imply that citizens calculate benefits of education any more, or any more carefully, than consumers calculate the benefits when they consider purchasing automobiles or shoes. Yet, the theory of consumer behavior is useful because of the predictions it implies; similarly, the investment theory of nonparents' support for public education is useful because it implies reactions to externalities which are at least consistent with what is occurring. These reactions include a tendency for migration, which brings geographic external effects of education, to depress expenditures per student (allocative effects), and to cause growing centralization of education finance (distributional effects).

We have alleged that public primary and secondary education brings external benefits in a variety of forms. Further, though more tentatively, we have found that some benefits are largely uncapturable by the investing community, and so may well affect both the willingness of citizens to support public education and their attitudes regarding the equitable way to share the cost burden. Are there any implications of these findings for public policy toward education?

Mobility of the population is a significant cause of geographical external benefits of education, for through migration the effects of education are transmitted beyond local boundaries. It might, appear, therefore, that one policy implication of our analysis is that population mobility should be reduced in order to avoid the problems caused by the existence of external effects. But no such implication exists. Eliminating population mobility in order to reduce spill-over effects would be analogous to eliminating international financial transactions in order to solve our balance of payments problem. Both might work, but with side effects too serious to contemplate. Our society is not likely to try to hamper population mobility, for this would conflict with our goals of maintaining individual freedom and economic efficiency.

The traditional economic remedies for the tendency of external economies to cause sub-optimal expenditures are (1) to subsidize the producer of the external benefits, or (2) to establish minimum standards of performance, or (3) to enlarge the decision-making unit so as to internalize the benefits. In the education-finance context the first prescription implies not only increasing state financial aid to local school districts as population mobility grows, but also increasing aid from other states. The second prescription involves some control by higher level governments over decisions formerly made in a more decentralized manner. These might relate to minima of effort and accomplishment such as length of school year, expenditure per pupil, teacher standards, and educational achievement by students. The third prescription -- enlarging the decision-making unit -- implies alteration of our traditional educational finance structure based on small school districts, and replacing it with a more centralized structure.

Similarly, if flows of external education benefits are bringing unwanted distributions of the burdens of supporting education, the desired distributions can be brought about, in principle, through appropriate intergovernmental transfers. It is true, though, that interstate transfers might well be involved, and with them arises again the involvement of the federal government and the controversy surrounding its proper role in education. In this controversy, economic efficiency is but one relevant consideration.

As mentioned above, one partial alternative to the more direct involvement of the federal government would be the adoption in all states of education standards which were high enough to bring educational attainments and quality throughout the nation closer to those of the "best" states. However, even if this were attainable, it would not necessarily eliminate the problem of the expenditure-depressing influence of spillovers of education benefits unless the standards were raised to the level at which expenditures would be as high as they would be if all benefits were taken into account by the investing community. Even then, the additional problem of obtaining a satisfactory distribution of the increased expenditure burden would remain; in fact it would probably be intensified because of the great financial burdens imposed on low income states.

Throughout this study we have been hampered by a lack of data, so that we have been unable to do much that we desired. Our quantitative findings are clearly incomplete, and any conclusions drawn from them must be considered extremely tentative. Nevertheless, while the limitations of this study are substantial, we retain the basic tenet that some measurement is better than none at all.

Our objective was not to develop a case for or against greater involvement in education by the federal government; while the observance of geographical external benefits of education indicates the broad national stake in local education decisions, this is surely not the only factor which should enter a full analysis of the case for enlarged federal participation in education. The "proper" degrees of federal influence on local school curricula, instructional techniques, textbooks, and teacher accreditation are among the issues which are still unresolved. To determine the "ideal" balance of control over education by individual citizens, local school boards, and by county, state and federal education agencies, is a complex matter. It is hoped, though that this study has helped to illuminate one facet of the issue by identifying and partially quantifying some forms of geographical external benefits of education.

Appendix A

Estimating Net and Gross Rates of Annual Migration for Clayton, Missouri, 1950 to 1960 -- Summary of Methodology

This appendix will (1) describe the methodology employed in estimating average annual migration to and from Clayton, Missouri, for the decade, 1950 to 1960, and (2) identify the sources of data used. In general, the methods and data sources are such that the procedures may be applied to any community for which estimates of migration rates are desired.

Referring to Table A-1, columns 1 and 2 show the 1950 Clayton white population by age and sex; columns 3 and 4 present similar data for the 1960 population. To facilitate computations, all data are stated in terms of the population's 1960 age.

Columns 5 and 6 show the net change in the population of each cohort over the decade; hence column 5 is equal to column 3 minus column 1, and column 6 equals column 4 minus column 2. Those data reflect changes in the population as a result of all causes -- births, deaths, in-migration, out-migration. Subtracting the birth data in columns 7 and 8 from columns 5 and 6, and adding the mortality data in columns 9 and 10, we are left with the net change in the population for the decade due solely to migration. These data are presented in columns 11 and 12.

In these computations, it has been assumed that the census data were valid as of January 1, 1950 and 1960. This is not strictly correct; actually, both censuses were taken as of April 1. However, the use of the January assumption allows the use of all the 1950 birth and death data.

Without this assumption it would be necessary to determine the numbers of births and deaths that occurred in Clayton before and after April 1 in each census year. This would be difficult, and the consequences of this adjustment would surely be minor.

The use of census population figures in the estimation of migration is not without hazards. This is true because of certain deficiencies in them, particularly in the 1950 data. For one thing, the 1950 census was characterized by "age-humping"[1] -- that is, a tendency for respondents to report ages rounded off to the nearest five or ten year level. This tendency was especially important when responses were provided by poorly educated persons or by unrelated individuals (such as domestic employees). By contrast, the 1960 census asked the year of birth rather than age. Thus, the 1960 age data were improved; but, in the process, some errors were introduced into the estimates of population change by age over the decade, and thereby into our migration estimates.

The Census Bureau has listed several additional errors that can exist in migration estimates such as this, based on census data.[2] The first of these concerns the relative completeness of the 1930 and 1960 census enumerations. There is good reason to suspect underenumeration, and more so for 1930 than 1960.[3] This differential underenumeration, in itself, would lead to findings of larger population increases, or smaller decreases, than actually concerned.

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[1] This was pointed out by Ansley Coale of the Population Research Center, Princeton University. For additional discussion see his,"The Population of the United States in 1950 Classified by Age, Sex and Color -- A Revision of Census Figures," Journal of the American Statistical Association, March, 1955.

[2] U.S. Bureau of the Census, Current Population Report, Series P-23, Number 7, "Components of Population Change, 1950 to 1960, For Counties, Standard Metropolitan Statistical Areas, State Economic Areas, and Economic Subregions," (Washington: U.S. Government Printing Office, November, 1962), p. 13.

Another weakness, not present in this particular study but which might be present in other applications, deals with boundary changes of the area under study. It is obviously of extreme importance that the boundaries used for the population statistics be identical to those for the vital statistics.

With respect to vital statistics, there is once again the problem of underenumeration, this time of births and deaths. Added to this, paradoxically, is the simultaneous problem of overenumeration. This is especially possible in communities containing large hospitals. During the years 1930-1960, data in *Vital Statistics of the United States* were not always presented by place of residence, but sometimes only by place of occurrence. In the case of Clayton we have been assured that this problem has been avoided, and that place of residence has been the factor determining classification.

Lastly, the "migration" estimated by the method employed here may not be the migration in which one is interested. For example, the presence of a military installation in an area will influence the number of in-migrants; but perhaps one is interested only in civilian migration. In the Clayton study, the problem exists in a slightly different form -- in-migration of students to the area's three colleges. For some purposes, in-migration to attend college is not equivalent to in-migration to seek employment, and the community's reaction to each type of migration may differ.

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[3] Coale, *op. cit.*

In the Clayton case study the problems of underenumeration and age-heaping are surely present, although it is difficult to estimate their seriousness. The presence of colleges as a cause of in-migration does not appear to be troublesome, since we wish to estimate age-specific and sex-specific migration rates due to all causes.

Returning to the analysis of our migration data, annual rates of net migration are obtained by dividing one-tenth of the decade's net migration (thus assuming equal absolute annual migration) by the mean of the 1950 and 1960 populations in each class. Where there was no 1950 population, i.e., for 1960 ages under 10 years, the base used was the 1960 population.

The results obtained here do not yield the true rates of migration by year of age at the time of migration. For example, a migrant in the (1960) age cohort 20-24 years old could have migrated at any age between 10 and 24 (inclusive). That is, he could have migrated at age 10 (in 1950) or at age 24 (in 1960). Similarly, for the (1960) cohort 25-29 years old, migration could have occurred at ages 15 to 29 (inclusive).

Thus, both the cohorts 20-24 and 25-29 in 1960 include persons who could have migrated at ages 15 to 24 at the time of their migration.

Since migration for each five-year cohort could have occurred at fifteen different years of age, these rates (obtained above) needed to be adjusted. First they were plotted graphically at the midpoint of the 15 year span. Smooth curves were then drawn in such a way that the arithmetic means of the fifteen annual rates were approximately equal to the rate plotted at the fifteen-year midpoint. Finally, the rates for individual years of age were read off the charts. These were the rates which entered our computations of net spill-overs, and they are presented in Table A-2, columns 3 and 6.

The data shown in Table A-2 appear to be internally consistent. The age-patterns of migration rates for males and females are very similar. (Only white persons are considered; the non-white population of Clayton is negligible.) Out-migration is heaviest among the young persons, 4-18 years old, and among adults, 25-35, who would tend to be the parents of these children. In-migration seemed to peak at ages around the late teens. This is consistent with two facts: (1) Many of these people are of college age and thus would be enumerated as Clayton residents if they resided on the campus of one of three colleges within Clayton -- Fontbonne College, Concordia Theological Seminary, and most of the dormitories of Washington University. Increases in dormitory populations occurred during the decade, particularly at Washington University. (2) In-migration among young adults just starting careers would be expected to be large. Employment increased in Clayton during the decade as a result of the construction of new department stores and other retail establishments, and also as a result of the influx and growth of financial and other office facilities.

Having estimated net migration rates, we turn our attention to the computation of gross migration rates. The gross number of in-migrants to Clayton for the 1950-1960 decade is estimated by doubling the number found by the census for the period 1955-1960. Specifically, the 1960 census asked the question, "Where did you live in 1955?" Of the (white) Clayton population 5 years old and older, 4,432 reported living outside St. Louis County in 1955, while another 2,334 reported living in another house in St. Louis County.[4] While the former group clearly consists entirely of in-migrants, the latter group does not, as it includes intra-Clayton movers as well as movers into Clayton from elsewhere in St. Louis County. The problem thus becomes one of estimating how many of these intra-County movers were not intra-Clayton movers. Based upon information supplied by Miss Mildred Kastor, and upon estimates made by David Pittman and Miss Sarah Boggs,[5] we estimated this figure at approximately 67 percent of the intra-County movers, or about 12 percent of the 1960 Clayton population 5 years and older.[6] This amounts to 1,703 persons, which, together with the 4,452, yields an estimated in-migration total of 6,155 for the 5 year period. Doubling this gives the estimate of 12,310 white in-migrants for the decade. In all likelihood this is an understatement, for the census findings understate the gross migration to and from Clayton. By asking residents in 1960 where they resided in 1955, enumerators failed to record the in-migration since 1955 of persons who subsequently out-migrated prior to the date of the census.

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[4] U.S. Bureau of the Census, U.S. Census of Population: 1960. General Social and Economic Characteristics, Missouri. Final Report PC (1) - 27 C. (Washington: U.S. Government Printing Office, 1962), Table 27-73, p. 27-222.

[5] David Pittman and Sarah Boggs, Analysis of Population and School Enrollment Trends in the Clayton School District. (St. Louis: Washington University, Social Science Institute, ditto, May, 1962), Table 12a, p. 98. Miss Mildred Kastor is Director of Vital Statistics, St. Louis County Health Department.

The number of out-migrants is calculated as a residual; having the estimate of 12,310 gross in-migrants, and 1,733 net out-migrants, we estimate gross out-migration at 14,043 persons.

Finally, we wish to identify these gross in- and out-migrants by age, as we did for net migrants. No data for Clayton were available, so we assumed that the age distributions of the gross in- and out-migrants were essentially the same as the distribution for the nation as a whole. That is, if the national migration rate at age _a_ was twice as high as at age _b_, we assumed that the rate for Clayton was also twice as high at _a_ as at _b_.

From 1950 national census data (1960 data were not available), the number of annual migrants in each age group, as a percentage of the total population in that age group, can be calculated.[7] The percentages are multiplied by the average Clayton population for each age group, 1930-1960 (as previously obtained), and then multiplied again by a constant proportionality factor chosen so that it yields the previously determined number of total migrants.[8/] The results appear in column 13.

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[6] This 13 percent estimate was obtained from an analysis of the Pittman-Boggs data (_op. cit._) on movers into Clayton schools.

[7] U.S. Bureau of the Census, _U.S. Census of Population: 1950_, Vol. IV, Special Reports, Part 4, Chapter D, _Population Mobility -- Characteristics of Migrants_ (Washington: U.S. Government Printing Office, 1957), Tables 1 and 2, pp. 12-13.

Figures in column 13 relate to the total number of in and out-migrants. Next we need to divide these age-specific totals into numbers of gross out- and in-migrants. This is done by dividing the gross number (in column 13) in a manner such that the difference between gross in- and out-migration at each age equals the previously calculated number of net migrants at that age (as shown in columns 11 and 12). For example, if the net migration at age x was known to be -200 and the gross in- and out-total to be 2,000, there must have been gross out-migration of 1,100 and gross in-migration of 900 persons.

The division of the migrants by sex is again based on national data. The percentages of national migrants consisting of males at each age are computed and applied to the age-specific data to obtain male migration estimates for Clayton. They appear in columns 14 and 15. Estimates for females could be made in an entirely analogous fashion, although of course, once we have the figures for males, those for females are residual (columns 16 and 17). Columns 14 and 15 are then adjusted so that their difference for each age-specific group equals the previously

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[8/] That "proportionality factor" turned out to equal 3.2 for Clayton; that is, Clayton migration rates averaged about 3.2 times as high as the national figures.

calculated net migration, columns 11 and 12. For example, at age 20-24, we estimated net male in-migration at 232 and net female in-migration at 320 (from columns 11 and 12). Then we divided the total migration figure for that age group so that in-migrants exceeded out-migrants by the known total of 552 persons. If Clayton migration by sex for this (or any other) age were identical to national patterns, the division of in- and out-migrants by sex would yield the net figures of 232 and 320. But, the Clayton patterns are not identical to the national; hence adjustment is needed. Following our example, the use of national data yielded, for males, 1,093.1 in-migrants and 815.4 out-migrants, for a net in-migration of 277.7, compared with the previously calculated net figure of 232. For females, national data led to an estimated net in-migration of 276.3 compared with 320.

The estimated figures are 43.7 too low for females and 43.7 too high for males. We adjusted for this discrepancy by dividing the 43.7 by 2, adding the resulting 22.9 to the male out-migrant figure, raising it to 838.3, and subtracted 22.9 from the in-migrant figure, lowering it to 1,070.2. This then yielded the previously calculated net migration for males of 232. As the female estimate was too low, 22.9 was added to the in-migration level and subtracted from out-migration, yielding the calculated net in-migration of 320.

This adjustment was considered justifiable because the calculated levels of net migration (columns 11 and 12) came directly from Clayton data, while the Clayton estimates (columns 14 through 17) were based on national patterns.

Finally, rates of gross annual migration are computed by dividing the migration estimates (columns 18 through 21) by the mean 1950-1960 population. These rates are plotted as a function of age, and then smoothed, to obtain estimates for each single year of age. The rates are plotted at the mid-point of the age interval applicable to the particular cohort over the decade, just as was done when net migration rates were being estimated. The results are presented in Table A-2, columns 6 and 8.

TABLE A-1: DATA USED IN COMPUTING ANNUAL NET AND GROSS MIGRATION RATES, CLAYTON, MISSOURI WHITES ONLY, 1950-1960.

1960 Age	1950 Clayton Population Males (1)	1950 Clayton Population Females (2)	1960 Clayton Population Males (3)	1960 Clayton Population Females (4)	1950-1960 Change in Population Males (5)	1950-1960 Change in Population Females (6)	1950-1960 Births Males (7)	1950-1960 Births Females (8)	1950-1960 Deaths Males (9)	1950-1960 Deaths Females (10)	1950-1960 Net Migration Males (11)	1950-1960 Net Migration Females (12)
Under 1			114	100	+ 114	+ 100	0	0	0	0	+ 114	+ 100
1			101	97	+ 101	+ 97	119	126	3	3	- 15	- 26
2			72	78	+ 72	+ 78	117	104	3	2	- 42	- 24
3			84	82	+ 84	+ 82	109	94	0	2	- 25	- 10
4			94	79	+ 94	+ 79	97	87	7	2	+ 4	- 6
5			78	95	+ 78	+ 95	130	141	3	3	- 37	- 43
6			102	90	+ 102	+ 90	137	149	8	8	- 47	- 51
7			79	100	+ 79	+ 100	162	136	1	4	- 82	- 32
8			90	98	+ 90	+ 98	183	134	2	3	- 93	- 33
9			97	103	+ 97	+ 103	161	169	3	4	- 61	- 62
10	113	122	100	88	- 13	- 34	139	181	4	3	- 160	- 212
11	234	229	87	88	- 47	- 46	0	0	0	1	- 46	- 44
12			100	95			0	0	1	1		
13	249	237	121	90	- 29	- 50	0	0	0	1	- 27	- 49
14			99	97			0	0	2	0		
15	87	91	71	81	- 16	- 10	0	0	0	0	- 16	- 10
16	81	95	91	94	+ 10	- 1	0	0	0	0	+ 10	- 1
17	261	264	124	152	+ 23	+ 192	0	0	0	0	+ 23	+ 192
18			81	157			0	0	0	0		
19			79	147			0	0	0	0		
20-24	382	354	610	674	+ 228	+ 320	0	0	4	0	+ 232	+ 320
25-29	384	442	469	402	+ 85	- 40	0	0	3	2	+ 88	- 38
30-34	842	594	374	428	- 468	- 166	0	0	7	4	- 461	- 162
35-39	527	602	330	461	- 197	- 141	0	0	5	3	- 192	- 138
40-44	447	535	341	458	- 106	- 77	0	0	7	7	- 99	- 70
45-49	494	399	421	367	- 73	- 32	0	0	16	18	- 57	- 14
50-54	505	699	442	714	- 63	+ 15	0	0	29	23	- 34	+ 38
55-59	578	784	484	692	- 94	- 92	0	0	50	43	- 44	- 49
60-64	630	716	489	643	- 141	- 73	0	0	88	42	- 53	- 31
65-69	540	562	355	531	- 185	- 31	0	0	121	68	- 64	+ 37
70-74	357	463	266	355	- 91	- 108	0	0	107	74	+ 16	- 34
75-79	254	359	118	210	- 136	- 149	0	0	102	92	- 34	- 57
80-84	175	233	66	126	- 109	- 107	0	0	89	96	- 20	- 11
Over 84	152	302	42	71	- 110	- 231	0	0	146	244	+ 36	+ 13
TOTAL	7292	8282	6671	8343	- 621	+ 61	1404	1337	811	755	-1214	- 521

Table A-1 (Continued)

1960 Age	Adjusted Estimated Total Clayton Migrants 1950-1960 (13)	Estimated Gross Migration, Clayton 1950-1960 In Males (14)	Out Males (15)	In Females (16)	Out Females (17)	Adjusted Gross Migration Estimates Clayton, 1950-1960 In Males (18)	Out Males (19)	In Females (20)	Out Females (21)
Under 1	507.5	364.0	327.2	339.7	306.5	363.6	327.6	360.1	306.1
1	469.4								
2	355.8								
3	393.6								
4	410.2								
5	325.4	244.1	339.0	233.6	313.7	221.5	361.6	236.2	493.1
6	361.3								
7	282.2								
8	296.6								
9	266.9								
10	282.9	285.1	366.2	268.4	333.1	265.8	386.3	288.5	313.2
11	556.5								
12									
13	298.9								
14	514.6								
15	264.3	389.0	489.0	377.4	479.4	347.5	530.3	618.9	457.9
16	416.0								
17	1,454.4								
18									
19									
20-24	3,794.2	1,093.1	815.4	1,080.0	885.7	1,070.2	838.3	1,100.9	775.8
25-29	2,665.3	722.8	695.2	635.9	611.5	734.0	666.0	606.7	665.7
30-34	2,506.6	508.6	845.0	433.2	719.8	444.3	907.3	695.5	637.8
35-39	1,489.9	315.5	495.0	264.5	613.8	309.2	505.3	378.8	608.7
40-44	1,382.7	330.2	422.1	276.7	333.8	326.4	433.7	300.3	358.3
45-49	1,036.2	233.4	290.6	229.2	263.0	243.5	300.3	239.1	273.1
50-54	1,174.4	309.3	307.2	279.9	278.0	291.2	323.3	298.0	238.9
55-59	1,263.0	307.1	356.0	277.9	322.0	309.6	313.5	275.6	326.7
60-64	1,233.0	301.6	345.7	272.9	312.8	297.1	350.2	277.6	308.3
65-69	836.5	178.1	190.0	226.7	261.8	132.0	216.1	231.8	313.7
70-74	606.7	129.5	137.5	164.9	176.9	141.5	123.5	150.9	186.9
75-79	396.5	67.2	107.3	85.6	136.5	70.3	106.2	85.3	139.6
80-84	252.5	48.8	62.4	62.0	79.4	52.0	39.2	58.0	85.6
Over 84	239.0	62.9	42.2	80.1	33.0	69.6	23.3	73.6	80.2
TOTAL	26,333.0	6,310.3	7,333.0	5,987.9	6,800.1	6,124.3	7,411.8	6,184.5	6,613.3

Sources for Table A-1:

Columns 1, 2 -- U.S. Bureau of the Census, *U.S. Census of Population: 1930*, Vol. II, *Characteristics of the Population*, Part 23, Missouri. (Washington: U.S. Government Printing Office, 1932), Table 23-33, p. 23-63.

Columns 3, 4 -- U.S. Bureau of the Census, *U.S. Census of Population: 1960, General Population Characteristics - Missouri*. Final Report PC (1) - 27B, (Washington: U.S. Government Printing Office, 1961), Table 27-20, p. 27-39.

Columns 7-10 -- Data supplied by Miss Mildred Kantor, Director of Vital Statistics, St. Louis County Health Department, Clayton 5, Missouri.

TABLE A-2

AVERAGE ANNUAL SURVIVAL AND MIGRATION RATES BY AGE AND SEX FOR WHITES, CLAYTON, MISSOURI, 1950 to 1960.

	MALES				FEMALES			
		Migration				Migration		
			gross[c]				gross[d]	
Age	Survival[a]	Net[b]	in	out	Survival[a]	Net[b]	in	out
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
6	.99962	- 0.079	0.045	- 0.124	.99967	- 0.060	0.050	-0.102
7	.99962	- 0.067	0.044	- 0.120	.99967	- 0.062	0.050	- 0.100
8	.99962	- 0.032	0.046	- 0.104	.99967	- 0.061	0.055	- 0.098
9	.99962	- 0.017	0.047	- 0.106	.99967	- 0.034	0.060	- 0.097
10	.99960	- 0.011	0.053	- 0.110	.99965	- 0.009	0.073	- 0.094
11	.99960	- 0.004	0.066	- 0.114	.99965	+ 0.015	0.081	- 0.087
12	.99960	+ 0.000	0.084	- 0.119	.99965	+ 0.027	0.097	- 0.082
13	.99960	+ 0.007	0.125	- 0.121	.99965	+ 0.038	0.115	- 0.080
14	.99960	+ 0.017	0.167	- 0.140	.99965	+ 0.050	0.132	- 0.080
15	.99883	+ 0.030	0.176	- 0.158	.99981	+ 0.060	0.164	- 0.082
16	.99883	+ 0.045	0.200	- 0.164	.99981	+ 0.069	0.179	- 0.090
17	.99883	+ 0.050	0.214	- 0.166	.99981	+ 0.070	0.200	- 0.110
18	.99883	+ 0.050	0.218	- 0.171	.99981	+ 0.069	0.214	- 0.150
19	.99883	+ 0.046	0.218	- 0.170	.99981	+ 0.063	0.216	- 0.154
20	.99821	+ 0.040	0.212	- 0.170	.99977	+ 0.045	0.200	- 0.155
21	.99821	+ 0.033	0.206	- 0.164	.99977	+ 0.023	0.166	- 0.155
22	.99821	+ 0.023	0.196	- 0.162	.99977	- 0.002	0.155	- 0.155
23	.99821	+ 0.016	0.177	- 0.156	.99977	- 0.022	0.143	- 0.154
24	.99821	+ 0.000	0.140	- 0.156	.99977	- 0.028	0.137	- 0.152
25	.99902	- 0.034	0.107	- 0.154	.99960	- 0.032	0.127	- 0.151
26	.99902	- 0.080	0.076	- 0.153	.99960	- 0.034	0.119	- 0.148
27	.99902	- 0.082	0.071	- 0.152	.99960	- 0.034	0.108	- 0.143
28	.99902	- 0.081	0.070	- 0.149	.99960	- 0.034	0.097	- 0.129
29	.99902	- 0.079	0.069	- 0.148	.99960	- 0.033	0.088	- 0.109
30	.99870	- 0.071	0.069	- 0.140	.99931	- 0.031	0.057	- 0.100
31	.99870	- 0.060	0.070	- 0.125	.99931	- 0.029	0.051	- 0.090
32	.99870	- 0.049	0.070	- 0.120	.99931	- 0.026	0.048	- 0.082
33	.99870	- 0.042	0.072	- 0.117	.99931	- 0.024	0.046	- 0.077
34	.99870	- 0.038	0.073	- 0.114	.99931	- 0.022	0.046	- 0.075
35	.99848	- 0.034	0.075	- 0.113	.99853	- 0.020	0.048	- 0.074
36	.99848	- 0.030	0.080	- 0.111	.99853	- 0.017	0.052	- 0.073
37	.99848	- 0.027	0.085	- 0.110	.99853	- 0.015	0.056	- 0.072
38	.99848	- 0.023	0.086	- 0.108	.99853	- 0.013	0.058	- 0.071
39	.99848	- 0.020	0.086	- 0.105	.99853	- 0.010	0.058	- 0.071
40	.99717	- 0.018	0.078	- 0.100	.99811	- 0.008	0.054	- 0.066
41	.99717	- 0.016	0.059	- 0.090	.99811	- 0.005	0.046	- 0.063
42	.99717	- 0.014	0.052	- 0.078	.99811	- 0.003	0.044	- 0.059
43	.99717	- 0.012	0.050	- 0.064	.99811	+ 0.000	0.043	- 0.045
44	.99717	- 0.010	0.052	- 0.060	.99811	+ 0.002	0.041	- 0.040
45	.99469	- 0.008	0.056	- 0.059	.99673	+ 0.004	0.042	- 0.038
46	.99469	- 0.006	0.059	- 0.060	.99673	+ 0.006	0.042	- 0.037
47	.99469	- 0.005	0.061	- 0.062	.99673	+ 0.007	0.042	- 0.036
48	.99469	- 0.005	0.062	- 0.069	.99673	+ 0.007	0.043	- 0.035
49	.99469	- 0.005	0.062	- 0.072	.99673	+ 0.005	0.042	- 0.036
50	.99120	- 0.006	0.061	- 0.072	.99498	+ 0.001	0.042	- 0.036

TABLE A-7

(Continued)

Age	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
51	.99120	- 0.006	0.060	- 0.072	.99498	- 0.006	0.040	- 0.038
52	.99120	- 0.007	0.059	- 0.072	.99498	- 0.007	0.038	- 0.040
53	.99120	- 0.008	0.058	- 0.067	.99498	- 0.008	0.036	- 0.044
54	.99120	- 0.009	0.057	- 0.065	.99498	- 0.008	0.036	- 0.036
55	.98421	- 0.009	0.056	- 0.064	.99279	- 0.008	0.037	- 0.036
56	.98421	- 0.010	0.055	- 0.063	.99279	- 0.007	0.037	- 0.036
57	.98421	- 0.010	0.054	- 0.063	.99279	- 0.005	0.039	- 0.036
58	.98421	- 0.010	0.053	- 0.063	.99279	- 0.003	0.041	- 0.043
59	.98421	- 0.011	0.048	- 0.062	.99279	+ 0.000	0.043	- 0.043
60	.97160	- 0.012	0.044	- 0.060	.98644	+ 0.007	0.043	- 0.043
61	.97160	- 0.014	0.036	- 0.058	.98644	+ 0.006	0.048	- 0.043
62	.97160	- 0.016	0.034	- 0.053	.98644	+ 0.008	0.049	- 0.040
63	.97160	- 0.016	0.031	- 0.048	.98644	+ 0.009	0.049	- 0.038
64	.97160	- 0.015	0.031	- 0.046	.98644	+ 0.008	0.049	- 0.037
65	.96061	- 0.011	0.032	- 0.040	.97860	+ 0.006	0.048	- 0.038
66	.96061	- 0.002	0.038	- 0.038	.97860	- 0.001	0.046	- 0.040
67	.96061	+ 0.006	0.046	- 0.034	.97860	- 0.004	0.042	- 0.042
68	.96061	+ 0.005	0.048	- 0.028	.97860	- 0.010	0.037	- 0.048
69	.96061	+ 0.003	0.047	- 0.030	.97860	- 0.013	0.034	- 0.048
70	.93970	- 0.003	0.046	- 0.035	.96248	- 0.019	0.025	- 0.048
71	.93970	- 0.021	0.044	- 0.043	.96248	- 0.022	0.022	- 0.050
72	.93970	- 0.022	0.041	- 0.050	.96248	- 0.023	0.019	- 0.050
73	.93970	- 0.022	0.038	- 0.056	.96248	- 0.023	0.019	- 0.050
74	.93970	- 0.022	0.037	- 0.060	.96248	- 0.022	0.019	- 0.050

a/ Survival probabilities show the proportion of the population at age a that will be alive one year later at age a + 1.

b/ Net migration probabilities show the proportional increase (+) or decrease (-) in the population at age a resulting from migration for one year.

c/ Gross migration probabilities show the number of expected in (+) and out (-) migrants of a given age and sex as a proportion of the Clayton population of that age and sex.

Appendix B

Values of Educational Capital for Various Levels of Educational Attainment

In Chapter 4 we presented data pertinent to the discussion of Clayton's production, exports, and imports of educational capital. Only estimates involving the value of a completed high school education were given, and then only for children of school ages. In this appendix, we present estimates of educational capital values for each of five levels of education, and for persons at various ages. This is done for white males and females, for both the South and the rest of the country. Again, both 5 and 10 percent discount rates are used. We have not included export and import (E.C. Ex. and E.C. Im.) values, as they depend on the specific migration rates of the community or area under study.

The data in Table B-1 differ from certain data in Tables 4-1, 4-2, and 4-3 only to the extent that national survival probabilities have entered the former as substitutes for St. Louis County probabilities. This makes the data in Table B-1 more appropriate for possible use in other studies. The formula by which the educational capital values were computed appears in Chapter 4. As the formula indicates, the figures in Table B-1 are the present values of the lifetime differentials between the incomes of persons with no formal education and the incomes of persons of the same age, sex, race, and region of residence with the stated level of education.

It is interesting, and at first glance surprising, to note that the monetary values of education are generally higher in the South than in the rest of the nation. This does not indicate that incomes at a given level of education are higher in the South -- for that is not the case -- but rather that schooling *raises* incomes more in the South.[1]

The estimates in Table B-1 are presented for every tenth year of age, and for the age at which a child normally completes the specific level of schooling under consideration.

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[1] See brief remarks on this point in Burton A. Weisbrod, "Tomorrow's Critical Manpower Demands: Comments," Conference on *Educational Needs for Economic Development of the South*, Asheville, North Carolina, June, 1962 (North Carolina State College, School of Agriculture, Agricultural Policy Institute, Series 7, October, 1962), pp. 37-38.

Table B-1

Value of Educational Capital Per Person (Whites Only) by Level of Education, Age, Sex, and Region, at 5 and 10 Percent Discount Rates, 1950

Note: Figures in this table have not been adjusted downward by the 0.6 factor discussed in Chapter 4.

Five Percent Discount Rate
(00 omitted)

Level of Education and Age		North and West Male (1)	North and West Female (2)	South Male (3)	South Female (4)
One to Four Years of Schooling					
Age	8	$49	$ 0	$10	$ 0
	10	56	0	39	0
	20	83	0	43	0
	30	67	0	39	0
	40	36	0	42	6
	50	11	0	23	6
	60	1	1	11	2
	70	0	1	6	0
Five to Seven Years of Schooling					
Age	13	83	0	98	6
	20	123	0	142	9
	30	108	0	141	10
	40	72	0	113	10
	50	37	2	76	3
	60	20	4	38	2
	70	10	3	11	0
Eight Years of Schooling					
Age	14	132	0	132	13
	20	172	0	199	19
	30	136	0	200	18
	40	114	7	168	19
	50	71	9	121	13
	60	42	7	65	7
	70	18	3	20	1

(continued on following page)

Table B-1 (Continued)

		(1)	(2)	(3)	(4)
Nine to Eleven Years of Schooling					
Age	18	1488	7	3206	33
	20	5160	9	5771	61
	30	2113	18	5083	68
	40	1413	21	3380	38
	50	1089	23	1770	27
	60	69	17	1115	13
	70	38	6	67	3
Twelve Years of Schooling					
Age	18	2649	94	3320	37
	20	2778	61	3649	1008
	30	3066	66	3779	86
	40	2113	33	2380	83
	50	1738	38	2231	64
	60	1013	31	1467	33
	70	43	10	38	10

Ten Percent Discount Rate
(00 omitted)

		(1)	(2)	(3)	(4)
One to Four Years of Schooling					
Age	8	$ 14	$ 0	$ 11	$ 0
	10	22	0	16	0
	20	53	0	33	0
	30	47	0	38	0
	40	28	0	29	2
	50	9	0	18	3
	60	1	1	9	2
	70	0	1	6	0
Five to Seven Years of Schooling					
Age	12	33	0	37	1
	20	72	0	77	6
	30	71	0	87	3
	40	31	0	73	7
	50	27	1	36	4
	60	13	2	30	2
	70	9	2	18	0

(continued on following page)

Table B-1 (Continued)

		(1)	(2)	(3)	(4)
Eight Years of Schooling					
Age	14	$ 59	$ 1	$ 43	$ 2
	20	90	8	106	10
	30	88	8	121	10
	40	78	9	118	11
	50	51	6	88	11
	60	34	3	54	9
	70	16	3	17	1
Nine to Eleven Years of Schooling					
Age	14	88	3	98	16
	20	120	6	143	22
	30	133	2	168	22
	40	100	11	136	23
	50	76	13	122	19
	60	33	13	88	18
	70	26	6	41	3
Twelve Years of Schooling					
Age	18	126	37	151	32
	20	148	38	177	37
	30	163	51	206	48
	40	138	38	213	56
	50	108	33	179	68
	60	78	26	116	37
	70	38	9	44	9

Source: Computed according to formula in Chapter 4, from income data calculated from U.S. Bureau of the Census, U.S. Census of Population: 1950, Vol. IV, Special Reports, Part 5, Chapter B, Education (Washington: U.S. Government Printing Office, 1953), Tables 12 and 13; and from survival probabilities in U.S. Department of Health, Education, and Welfare, Public Health Service, National Office of Vital Statistics, "United States Life Tables, 1949-51," Vital Statistics Special Reports, 41, No. 1 (November 23, 1954), pp. 10-11.

Appendix C

Value of the Option to Obtain Additional Education

This study has attempted to identify and quantify benefits from elementary and secondary education; thus, there has been no explicit consideration of college education, although it has been stated that the forms of benefits discussed in Chapter 2 will generally apply to higher as well as lower education. Yet, benefits from college education are relevant even to a discussion of lower education for the obvious reason that without the latter the former would be impossible.

Since elementary and secondary schooling are necessary preconditions for entrance to college, some of the returns -- financial and otherwise -- to college education may be appropriately attributed to lower education. In other words, the value of lower education lies partly in the opportunity or option which it provides people to go to college.

The basic idea of the value of lower education in producing an option to pursue higher education has been discussed in Chapter 2. This appendix will present a mathematical statement of the concept, and will discuss some of its implications for this study.[1] As stated earlier, the value of additional education may be thought of as having two components: (a) the additional earnings resulting from completion of a given level of education (properly discounted to the present), and (b) the value of the "option" to obtain still further education and the rewards accompanying it. It is (b) which we wish to elaborate upon here.

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[1] The essence of the following discussion first appeared in Burton A. Weisbrod, "Education and Investment in Human Capital," *Journal of Political Economy Supplement*, LXX (October, 1962), pp. 106-23.

In equation (1) below, the first term represents the rate of return over cost for education unit *j*, as computed in the usual manner; it is the difference between the present value of expected future earnings of a person who has attained, but not exceeded, level *j*, and the present value of expected future earnings of a similar person without education *j*, as a percentage of the additional cost of obtaining *j*. This is the rate of return as generally computed. Subsequent terms in the formula measure the option value of completing *j*, and should be understood as follows: each of the R^* are rates of return on incremental education *k*, computed in the manner described in the paragraph above. $\bar{R}$ is the opportunity cost of expenditure on education in terms of the percentage return obtainable from the next best investment opportunity, so that $R^*_k - \bar{R}$ indicates any "super-normal" percentage returns. C_k is the marginal social cost of obtaining the incremental education, *k*, (where each cost ratio C_k/C_j is a weighting factor permitting the percentage returns on the costs of various levels of education to be added), and P_k is the probability that a person who has attained level *j* will go on to various higher levels.

$$\begin{aligned} R_j &= R^*_j + (R^*_k - \bar{R})\ \frac{C_k}{C_j} \cdot P_k \\ &\quad + (R^*_l - \bar{R})\ \frac{C_l}{C_j} \cdot P_l \ +\ldots \\ &\quad + (R^*_n - \bar{R})\ \frac{C_n}{C_j} \cdot P_n \\ &= R^*_j + \sum_{k=k}^{n} \ (R^*_k - \bar{R})\ \frac{C_k}{C_j} \cdot P_k \qquad (1) \end{aligned}$$

Formula (1) indicates that the value of the option to pursue additional schooling depends upon (1) the probability of its being exercised and (2) the expected value, if exercised. Without further information, factor 1 may be estimated by the proportion of persons completing a particular level of education who go on to a higher level. The expected value of the option if exercised, factor 2, is any excess of the return on that increment of education over the return obtainable on the best comparable alternative investment, where the latter may be assumed to equal, say, 5 percent. Actually, the "excess" returns should be discounted back to the decision date from the time the higher education level would begin, but to illustrate the point simply, we shall disregard this, at least to begin with.

According to some recent estimates reported elsewhere, the return to the individual on total high school costs (including foregone earnings) for white urban males in 1939[2] was approximately 16 percent and the return on college costs for those who graduated was estimated at 9 percent.[3] We might assume the return to be somewhat lower -- say 8 percent -- for those who did not complete their college training. Thus, with approximately 46 percent of male high school graduates beginning college and 26 percent graduating,[5] a social expected return on a social investment in high school education in 1939 for a male was, substituting into equation (1) above, 17.4 percent, as shown in equation (2).

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[2] T. W. Schultz, "Education and Economic Growth," *Social Forces Influencing American Education* (hereinafter cited as "Economic Growth") (Chicago: National Society for the Study of Education, 1961), Chap. III, referring to G. S. Becker's work. H. S. Villard has seriously disagreed with these estimates. See his "Discussion" of Becker's "Underinvestment in College Education?" in *American Economic Review Proceedings*, L (May, 1960), pp. 375-78. See also W. Lee Hansen, "Total and Private Rates of Return on Investment in Schooling," *Journal of Political Economy*, LXXI (April, 1963), pp. 128-40.

[3] Schultz, "Economic Growth," *op. cit.*, p. 78.

To calculate, the first term 16, is the estimated percentage direct return to high school education. In subsequent terms, the first element is an estimate of the return in excess of alternatives, obtainable on additional education; the second element is the total cost of the additional education as a proportion of the cost of high school education;[6] the third element is the proportion of high school graduates who obtain the additional education. If the returns to college education were discounted back four years to the date at which high school education was initiated, at a 5 percent discount rate, the expected return to high school education would drop to 16 + 2.1 × 0.7, or 16.8 percent instead of 17.4

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[5] Computed from 1958 data for males 25-29 (who would have graduated from high school during the years 1950-55), in U.S. Bureau of the Census, *Current Population Reports: Population Characteristics, Projections of Educational Attainment in the United States, 1960-1980* (hereinafter cited as *Educational Attainment*) (Series P-20, No. 91, January 12, 1959, Table 1, p. 8.)

Data on the percentage of high school graduates beginning college in the *early nineteen fifties* were used in the computations of returns from high school education in *1939* because of the unusual forces affecting education decisions in the wartime and immediate post-war years.

[6] Computed from data in Schultz, "Economic Growth," *op. cit.*, p. 70.

percent.[6]

High-School Graduation 10 × College Graduation (9-2) (1.70) (.28) × Some College (Assumed = 2 years) (8-2) (1.10) (.28)

$$= 10 + 3.6 + 3.8 = 17.4 \text{ percent} \qquad (2)$$

Grade-School Graduation 35 × High-School Graduation (10-2) (5.3) (.87) × College Graduation (9-2) (6.3) (.16) × Some College (Assumed = 2 years) (8-2) (5.1) (.13)

$$= 35 + 13.8 + 2.8 + 1.2 = 52.8 \text{ percent} \qquad (3)$$

The option value of high school education increased the rate of return on high school costs from 10 to 17 percent, considering only the "monetary" returns. For grade school education, recognition of the value of the option to obtain additional education increased the expected 1939 return even more substantially above the previous estimate of 35 percent.[7] The option turned out to be quite valuable indeed, increasing the return on elementary education from 35 to 53 percent. It could be argued in this case that whether the return was 35 or 54[8] percent is relatively immaterial for policy purposes, both being considerably greater than available alternatives. However, given the state of our confidence in the previously computed rates of return, it is comforting to see the estimates moved further from the decision-making margin. Of course, in addition to these returns, assuming they are attributable solely to education, are the non-market returns to education, including the direct consumption value of learning and the opportunity to lead the "full life."

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[6] In this example, it was assumed that a decision to complete high school would be realized with certainty. Other assumptions could easily be fitted into the framework. If knowledge existed regarding the prospective high school student's college plans, then the *average* probability of continuation should not be used.

[7] Again, disregarding the discounting. The 35 percent estimate is from Schultz, "Economic Growth," p. 81. Relative costs were estimated from the same source (p. 73) except that Schultz's elementary school cost figure was doubled, since it applied to only 4 years of school. The proportions of children continuing on to higher education were estimated from *Educational Attainment*, op. cit., p. 8.

In this appendix, we do not discuss any option value for college education; however, there may be a positive option value related to opportunities for graduate study and additional on-the-job training.

What are the implications of this concept for our case study? How might the presence of this benefit of education alter our results? Throughout this study, we have assumed that the students are, or will become high school graduates, but, by implication, nothing more. Using this assumption, we have calculated the monetary (and other) benefits commensurate with this level of education.

But this assumption is not valid. For example, for the years 1950-59, 80.0 percent of the Clayton High School graduates went on to college[9] while for the nation as a whole, 48.7 percent continued their schooling.[10]

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[8] Previous estimates of rates of return represented a discounting of costs and returns back to the beginning of that particular level of schooling; since our time bench mark is the beginning of grade school, the values of the high school and college options should be discounted back to the beginning of grade school. Doing so, at a discount rate of 5 percent, reduces the 54 percent return to 35 + 9.5 + 2.1 + 0.7, or 47.3 percent. This return would almost certainly be larger if persons obtaining only some high school education were also considered.

[9] Letter from George M. Stuber, Assistant to the Superintendent, Clayton School District, May 8, 1963.

[10] This is an average for the 9 graduating classes of 1950 through 1958. U.S. Bureau of the Census, Statistical Abstract of the United States: 1962 (83rd edition) (Washington: U.S. Government Printing Office, 1962), Table 146, p. 116.

Without going into detailed quantification at this point, we merely wish to point out that some portion of the additional income earned by college graduates (or former undergraduates) as well as some portion of all income-related benefits are attributable to these students' public school education, and hence are benefits of public education in every sense of the word.

Thus, by disregarding the option to obtain additional education, an option created by public elementary and secondary education, we have understated both the total and spill-over benefits of this education. Obviously, the degree of the understatement is dependent upon the proportion of students who utilize this option. In the extreme case in which no one goes on to higher education, there is no understatement; but the fact that such a high percentage of high school graduates goes on to college means that we have understated both total and spill-over benefits of public education by neglecting the option value. The major point to be made here is that for any community or region, as well as for the nation as a whole, there is a danger of considerable understatement of the benefits of elementary and secondary education due to the failure to consider their option values for obtaining higher education.